UC864-E/G/WD/WDU Software User Guide

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Making machines talk.

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1. Introduction

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1.1. Scope

The scope of this document is to provide a hardware description of the Telit UC864-E/G/WD/WDU.

1.2. Audience

This document is intended for customers integrating UC864-E/G/WD/WDU modules in their project.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit's Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit's Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

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1.4. Document Organization

This document contains the following chapters:

"Chapter 1: "Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: "Overview" gives an overview of the features described in the document.

"Chapter 3: "UC864 Family Products Specification" describes in details the characteristics of the product, providing information such as power supply requirements, mechanical dimensions and interfaces specifics.

"Chapter 4: "Basic operations" : gives an overview on the basic operations using AT command: switch on/off, formatting, response, placing a voice call, etc.

"Chapter 5: "Advanced operations" : gives an overview on the advanced operations: access to phonebook, call handling, messages, GPIO setting, alarms, power consumption management etc.

"Chapter 6: "Packet switched data operations": deales on the GPRS data managemet. It describes Enhanced Easy GPRS fuatures.

"Chapter 7: "GPS operations": describes GPS handling for UC864-G. It provides an overview on NMES sentences, message formatting, GPS power management and serial ports for communications.

"Chapter 8: "Service and firmware update" describers the procedure and software tools used to update the firmware of UC864.

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1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related documents

a. UC864-E/G/WD/WDU Product description, 80281ST10034a
b. UC864-E/G/WD/WDU Hardware User Guide, 1vv0300766a

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1.7. Document History

Revision	Date	Changes
ISSUE #0	08/11/07	First release
ISSUE #1	24/10/08	General revision of the document. main changes are: Unified UC864-E and UC864-G software user guide Added § 2.5 and § 2.6 Turn ON/OFF UC864-G In § 2.2Added new commands: ▪ #CAP ▪ #SRS ▪ #SRP ▪ #STM ▪ #PCT ▪ #SHDN ▪ #QTEMP ▪ #MONI ▪ #CGMI ▪ #CGMM ▪ #CGMR ▪ #CGSN ▪ #CIMI Added § 2.7.3.4 Quick Network Status Checking Added § 3.5 Power Saving Mode Added § 3.7 Using General Purpose Input/Output Pins Added § 3.8.2.2.2 Exit from alarm status and enter the normal operating mode Added § 3.8.2.3 Querying the alarm status Added § 5 GPS Operations Added § 6 Service and Firmware Update
ISSUE #2	04/02/09	Updated §1. Overview Added §2. UC864 family Product Specification Deleted description of § 3.3 Turn ON/OFF the UC864-E/G/WD/WDU because it can refer to to HW user guide.
ISSUE #3	24/06/09	Added 3.8 Data Flow Control Modified UC864-E/G naming rule Added XFT tool usage description

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2. Overview

The purpose of this document is the description of some common AT command procedures that may be used with the Telit UC864 family module. In this document, all the basic functions of a mobile phone are taken into account and for each one of them, a proper command sequence will be suggested. In the Advanced operation section the more useful services and features of the GSM and WCDMA network supported by the Telit UC864 family module is taken into account and some command sequence and usage are provided for each one of them. This document and its suggested command sequences must not be considered mandatory; instead, the information given must be used as a guide for properly using the Telit module. For further commands and features that may not be explained in this document refer to the UC864 family Product Description document where all the supported AT commands are reported.

NOTE:

The integration of the GSM/GPRS GC864-QUAD / PY cellular module within user application shall be done according to the design rules described in this manual

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3. UC864 family Product Specification

ITEM	FEATURE			
	UC864-E	UC864-G	UC864-WD	UC864-WDU
Air interface	▪ Single-Band UMTS/HSDPA 2100MHz ▪ Quad-Band GSM 850/900/1800/1900	▪ Tri-band UMTS/HSDPA 2100/1900/850 ▪ Quad-Band GSM 850/900/1800/1900 ▪ Standalone GPS	▪ Dual-band UMTS2100 /900 ▪ Dual-Band GSM 900/1800	▪ Dual-band UMTS1900 /850 ▪ Dual-Band GSM 850/1900
Size	36.2(L)X30(W)X4.8(T)	45(L)X30(W)X4.8(T)		
Data Service	HSDPA UL 384kbps, DL 7.2Mbps WCDMA UL/DL 384kbps, EDGE UL/,DL 236.8Kbps, GPRS UL/DL 85.6 Kbps, CSD 9.6Kbps		WCDMA UL/DL 384kbps, EDGE UL/,DL 236.8Kbps, GPRS UL/DL 85.6 Kbps, CSD 9.6Kbps	

NOTE:

In the following sections, UC864 family refers to all UC864 products mentioned in the table above. Whenever a command and/or feature is referred to a specific model, it is clearly highlighted.

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4. Basic Operations

4.1. Command Syntax

In the next paragraphs the following notations are used:

<cr> represents the Carriage Return Character (13)

<lf> represents the Line Feed Character (10)

<xx> represents a parameter with changing name is in place of the double x. (< and > characters are only for limiting the parameter and must not be issued to the terminal).

[<xx>] represents an optional parameter whatever name is in place of the xx.

[and] characters are only for limiting the optional parameter and must not be issued to the terminal).

4.2. Command Response Timeout

Every command issued to the Telit modules returns a result response if response codes are enabled (default). The time needed to process the given command and return the response varies, depending on the command type. Commands that do not interact with the SIM or the network, and involve only internal set up settings or readings, have an immediate response, depending on SIM configuration(e.g., number of contacts stored in the phonebook, number of stored SMS), or on the network the command may interact with.

In the table below are listed only the commands whose interaction with the SIM or the network could lead to long response timings. When not otherwise specified, timing is referred to set command. For phonebook and SMS writing and reading related commands, timing is referred to commands issued after phonebook sorting is completed. For DTMF sending and dialing commands timing is referred to module registered on network ("AT+CREG?" answer is "+CREG: 0,1" or "+CREG: 0,5").

NOTE:

In case no response is received after the timeout time has been elapsed, then try repeating the last command and if still no response is received until the timeout time an Unconditional Shutdown MUST be issued and the device must be powered ON again.

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Command	Time-Out (Seconds)
+COPS	95 (test command)
+CLCK	15 (SS operation)
	5 (FDN enabling/disabling)
+CPWD	15 (SS operation)
	5 (PIN modification)
+CLIP	15 (read command)
+CLIR	15 (read command)
+CCFC	15
+CCWA	15
+CHLD	30
+CPIN	30
+CPBS	5 (FDN enabling/disabling)
+CPBR	5 (single reading)
	15 (complete reading of a 500 records full phonebook)
+CPBF	10 (string present in a 500 records full phonebook)
	5 (string not present)
+CPBW	5
+CACM	5
+CAMM	5
+CPUC	180
+VTS	20 (transmission of full “1234567890*#ABCD” string with no delay between tones, default duration)
+CSCA	5 (read and set commands)
+CSAS	5
+CRES	5
+CMGS	120 after CTRL-Z; 1 to get ‘>’ prompt
+CMSS	120 after CTRL-Z; 1 to get ‘>’ prompt
+CMGW	5 after CTRL-Z; 1 to get ‘>’ prompt
+CMGD	5 (single SMS cancellation)
	25 (cancellation of 50 SMS)
+CNMA	120 after CTRL-Z; 1 to get ‘>’ prompt
+CMGR	5
+CMGL	100
+CGACT	150
+CGATT	90
D	120 (voice call)
	Timeout set with ATS7 (data call)
A	30 (voice call)
	Timeout set with ATS7 (data call)
H	30
+CHUP	5

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Command	Time-Out (Seconds)
+COPN	10
+COPL	180
+CRSM	180
+FRH	Timeout set with ATS7
+FTH	Timeout set with ATS7
+FRM	Timeout set with ATS7
+FTM	Timeout set with ATS7
+FRS	Timeout set with the command itself
+FTS	Timeout set with the command itself
+WS 46	10
#MBN	10
#TONE	5 (if no duration specified)
#EMAILD	60
#EMAILACT	150
#SEMAIL	210 (context activation + DNS resolution)
#MSCLASS	15
#STSR	30
#GPRS	150
#SKTD	140 (DNS resolution + timeout set with AT#SKTCT)
#SKTOP	290 (context activation + DNS resolution + timeout set with AT#SKTCT)
#QDNS	170
#FTPOPEN	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPCLOSE	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPTYPE	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPDELE	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPPWD	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPCWD	500 (timeout set with AT#FTPTO, in case no response is received from server)
#FTPLIST	500 (timeout set with AT#FTPTO, in case no response is received from server) + time to get listing
#FTPPUT	500 (timeout set with AT#FTPTO, in case no response is received from server)
#SGACT	150
#SH	10
#SD	140 (DNS resolution + connection timeout set with AT#SCFG)

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Command	Time-Out (Seconds)
#CSURV	95
#CSURVC	95
#CSURVUC	95
#CSURVB	95
#CSURVBC	95
#CSURVP	95
#CSURVPC	95

4.3. Turning ON/OFF the UC864 family

Please refer to UC864-E/G//WD/WDU Hardware User Guide

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4.4. Checking WCDMA Device Functionality

After a proper power on, the device is ready to receive AT commands on the USB or serial port.

Several things must be checked in order to be sure that the device is ready to send and receive calls and SMS.

4.4.1. Baudrate

UC864 family does not support autobauding. Users have to set the right speed for serial communication before device initialization. If UC864 family set the right speed, the device responds with OK. The default baudrate is 115200.

- send command AT+IPR=<rate><cr>
- wait for OK response

where rate is the port speed and can be 0, 300,1200,2400,4800,9600,19200,38400,57600,115200, 230400 bps.

TIP:

The USB or serial port suggested setting is: port speed 115200, character format 8N1 (8 bit per char, No parity bit, 1 stop bit).

4.4.2. SIM Presence Checking

The first thing to check is the SIM presence and PIN code insertion. This can be done with the following commands:

4.4.2.1. Enable the Extended Error Result Codes

- send command AT+CMEE=1<cr>
- wait for OK response
- or if you prefer the verbose format instead of the numerical format then: send command AT+CMEE=2<cr>
- wait for OK response

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4.4.2.2. Query SIM Presence and Status

- send command AT+CPIN?<cr>
- wait for response:

Response	Reason	Action
+CPIN: SIM PIN	SIM is present and PIN is required to continue operations	Proceed to par. 4.4.2.3
+CPIN: SIM PUK	SIM is present and 10 attempts to give SIM PIN have failed, so SIM is blocked	Send command AT+CPIN=<SIM PUK>
+CPIN: SIM PIN2	SIM is present and 3 attempts to give SIM PIN2 have failed, so SIM PUK2 is required	Proceed to par. 4.4.2.3
+CPIN: SIM PUK2	SIM is present and 10 attempts to give SIM PUK2 have failed, so SIM PIN2 cannot use anymore.	Send command AT+CPIN=<SIM PUK>
+CPIN: READY	SIM is present and no PIN code is required to proceed	Proceed ahead
+CME ERROR: 10	SIM is not inserted	Insert SIM or require SIM insertion and repeat from par. 4.4.2.2
+CME ERROR: 13	SIM is failure	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CME ERROR: 14	SIM is busy	retry later
+CME ERROR: 15	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).

4.4.2.3. Provide SIM PIN (only if required see point 4.4.2.2)

- send command AT+CPIN=****<cr> where **** stands for the SIM PIN code (e.g. 1234)
- wait for response:

Response	Reason	Action
OK	SIM PIN was correct	Proceed ahead
ERROR	the PIN code inserted is not correct	Retry from par. 4.4.2.2

NOTE:

When receiving the ERROR message, repeat Query SIM presence and status since after 3 failed attempts SIM PIN is not requested anymore, but SIM PUK is requested instead. You may need to go through procedure 4.4.2.4

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4.4.2.4. Provide SIM PUK (only if required see par. 4.4.2.2)

- send command AT+CPIN=*******,<newpin><cr> where ******* stands for the SIM PUK code (e.g. 12345678) and <newpin> (e.g. 1234) will replace the old pin in the SIM.
- wait for response:

Response	Reason	Action
OK	SIM PUK was correct	Proceed ahead
ERROR	the SIM PUK code inserted is not correct	Retry from par. 4.4.2.4

TIP:

When receiving the ERROR message, be careful to check if the SIM PUK is correct before trying again. After 10 failed attempts to provide the SIM PUK the SIM Card will lock and will not be usable anymore.

4.4.3. Network Checking

4.4.3.1. Query Network Status

- send command AT+CREG?<cr>
- wait for response:

Response	Reason	Action
+CME ERROR: 10	SIM not present or damaged	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CME ERROR: 11	SIM is present and PIN is required to continue operations	Repeat par. 4.4.2.3
+CREG: 0,0 or +CREG: 1,0	No network is found	Check for antenna cable connection (antenna may be disconnected or damaged) or change position if the antenna is OK. Repeat par. 4.4.3.1 until a network is found.
+CREG: 0,1 or +CREG: 1,1	Mobile is registered on its home network.	Proceed ahead. Ready to call
+CREG: 0,2 or +CREG: 1,2	Mobile is currently not registered on any network but is looking for a suitable one to register.	Repeat procedure at par. 4.4.3.1 to see if it has found a suitable network to register in.
+CREG: 0,3 or +CREG: 1,3	Mobile has found some networks but it is not allowed to register on any of them, no roaming was allowed.	Try in another place, and repeat procedure at par. 4.4.3.1

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+CREG: 0,4 or +CREG: 1,4	Mobile is in an unknown network status	Repeat procedure at par. 4.4.3.1 to see if it has found a suitable network to register in
+CREG: 0,5 or +CREG: 1,5	Mobile has found some networks and is currently registered in roaming on one of them	Proceed ahead. Ready to call

TIP:

When a response **+CREG: x,1** or **+CREG: x,5** is received, then the device is ready to place and receive a call or SMS. It is possible to jump directly to call setup procedures or SMS sending procedures.

4.4.3.2. Network Operator Identification

Once the mobile has registered on some network (or even if it has returned +CREG:x,3), it is possible to query the mobile for network identifications, codes and names:

- send command **AT+COPS=?<cr>**
- wait for response in the format:

+COPS: : [list of supported (<stat>,long alphanumeric <oper>,short alphanumeric <oper>,numeric <oper>,< AcT>)s]

[,,(list of supported <mode>s),(list of supported <format>s)]

where:

<stat> - operator availability

0 - unknown

1 - available

2 - current

3 - forbidden

<AcT> access technology selected:

0 GSM

2 UTRAN

NOTE:

Since with this command a network scan is done, this command may require some seconds before the output is given.

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For example:

command

AT+COPS=?<cr>

Answer:

+COPS: (2,"I WIND","WIND","22288",2),(1,"SI MOBITEL GSM","","29341",0),(1,"Vodafone IT","OMNITEL","22210",2), (3,"I TIM","TIM","22201",0),,(0-4),(0-2)

OK

In this case the mobile is registered on the network "I WIND" which is a network from Italy, code: 222 and Network ID: 88. There is also another network available for registration:

"SI MOBITEL GSM" which is a network from Slovenia, code: 293 and Network ID: 41 ,

"SI.MOBIL" which is a network from Slovenia, code: 293 and Network ID: 40 and

Vodafone IT from Italy with Nation code 22 and Network 10.

The other network is not available for registration:

NOTE:

This command issues a network request and it may require quite a long time to respond, since the device has to wait the answer from the network (it can be as long as 60 seconds). Do not use this command if not necessary.

"I TIM" from Italy, code: 222 and Network ID: 01 - FORBIDDEN

TIP:

In this case a "I TIM" logo might be reproduced on the MMI to give the user the information that is registered on that network.

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4.4.3.3. Check for Received Signal Strength & Quality

Once the mobile has registered on one network, it may be useful to know the received signal strength & quality to give the user an indication of the reliability of the network.

send command **AT+CSQ<cr>**

wait for response in the format:

<WCDMA network >

+CSQ: <rssi>,99

OK

<GSM network>

+CSQ: <rssi>,<ber>

OK

where:

<rssi> is an integer from 0 to 99 that indicates the received signal strength:

<rssi> value	Signal Strength	Indication
0	-113 dBm or less	Signal is VERY low: at the extreme sensibility limit
1	-111 dBm	MMI may indicate only 1 antenna bar
2	-109 dBm	MMI may indicate only 1 antenna bar
3	-107 dBm	MMI may indicate only 1 antenna bar
4	-105 dBm	MMI may indicate only 1 antenna bar
5	-103 dBm	MMI may indicate only 1 antenna bar
6	-101 dBm	MMI may indicate 2 antenna bars
7	-99 dBm	MMI may indicate 2 antenna bars
8	-97 dBm	MMI may indicate 2 antenna bars
9	-95 dBm	MMI may indicate 2 antenna bars
10	-93 dBm	MMI may indicate 3 antenna bars
11	-91 dBm	MMI may indicate 3 antenna bars
12	-89 dBm	MMI may indicate 3 antenna bars
13	-87 dBm	MMI may indicate 3 antenna bars
14	-85 dBm	MMI may indicate 3 antenna bars
15	-83 dBm	MMI may indicate 4 antenna bars
16	-81 dBm	MMI may indicate 4 antenna bars
17	-79 dBm	MMI may indicate 4 antenna bars
18	-77 dBm	MMI may indicate 4 antenna bars
19	-75 dBm	MMI may indicate 4 antenna bars
20	-73 dBm	MMI may indicate 4 antenna bars
21	-71 dBm	MMI may indicate 4 antenna bars

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22	-69 dBm	MMI may indicate 4 antenna bars
23	-67 dBm	MMI may indicate 4 antenna bars
24	-65 dBm	MMI may indicate 4 antenna bars
25	-63 dBm	MMI may indicate 4 antenna bars
26	-61 dBm	MMI may indicate 4 antenna bars
27	-59 dBm	MMI may indicate 4 antenna bars
28	-57 dBm	MMI may indicate 4 antenna bars
29	-55 dBm	MMI may indicate 4 antenna bars
30	-53 dBm	MMI may indicate 4 antenna bars
31	-51 dBm or more	MMI may indicate 4 antenna bars
99	not detected	MMI may indicate flashing antenna bars

NOTE:

When **<rssi>** is less than 6, with only 1 MMI antenna bar, the quality of a call will be poor and the call may even drop.

<ber> is an integer from 0 to 7 and 99 that reports the received signal quality measured on the radio traffic channel.

NOTE:

The quality is measured on the traffic channel. It is available only during a conversation. In Idle the reported value must not be considered.

In conversation the quality decreases with the increase of the **<ber>** number.

NOTE:

The **<ber>** value refers strictly to the GSM radio channel and is a very technical parameter. It can be used to monitor the voice call quality since the voice quality is inversely proportional to the **<ber>** number. UC864 family doesn't support ber in WCDMA network so the return value fixed as 99.

NOTE:

For Data calls the signal quality reported is not directly connected to the connection quality. The reported signal quality refers only to the GSM radio channel link and not to the whole path from the caller to the receiver, so it may happen that the quality on the GSM radio link is very good and hence the reported **<ber>** is 0 (good quality) but the quality of the remaining path to the other party is very bad and the final data connection quality is very poor.

For this reason the signal quality indicator **<ber>** must not be taken into account to monitor data calls quality.

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4.4.3.4. Quick Network Status Checking

Once the mobile has registered on one network, it may be useful to know the received signal strength and the network on which the mobile is registered. These information can be gathered with the commands **+CREG, +COPS** and **+CSQ,** which are part of the standard 3gpp GSM 07.07/27.007 commands as seen before, unfortunately these commands are not so fast in the response due to network response time, especially the **+COPS** command. If You want to keep your software as general as possible you can follow the indications given before and forget this part; instead if you need or want a faster way to check at the mobile network information, the UC864 family provides a special command **#MONI** which can be used to gather all the information needed in a faster and simpler way:

- send command **AT#MONI=0<cr>**
- wait for **OK** response
- send command **AT#MONI?<cr>**
- wait for response in the format:
  When extracting data for the serving cell and the network name is known the format is:

(GSM network)

#MONI: <netname> BSIC:<bsic> RxQual:<qual> LAC:<lac> Id:<id> ARFCN:<arfcn> PWR:<dBm> dBm TA: <timadv>

(WCDMA network)

#MONI: <netmame> PSC:<psc> RSCP:<rscp> LAC:<lac> Id:<id> Eclo:<ecio> UARFCN:<uarfcn> PWR:<dBm> dBm DRX:<drx> SCR:<scr>

When the network name is unknown, the format is:

(GSM network)

#MONI: Cc:<cc> Nc:<nc> BSIC:<bsic> RxQual:<qual> LAC:<lac> Id:<id> ARFCN:<arfcn> PWR:<dBm> dBm TA: <timadv>

(WCDMA network)

#MONI: Cc:<cc> Nc:<nc> PSC:<psc> RSCP:<rscp> LAC:,<lac> Id:<id> Eclo:<ecio> UARFCN:<uarfcn> PWR:<dBm> dBm DRX:<drx> SCR:<scr>

When extracting data for an adjacent cell, the format is:

(GSM network)

#MONI: Adj Cell<n> [LAC:<lac> Id:<id>] ARFCN:<arfcn> PWR:<dBm> dBm

(WCDMA network)

#MONI: PSC:<psc> RSCP:<rscp> Eclo:<ecio> UARFCN:<uarfcn> SCR:<scr>

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where:

<netname> - name of network operator

<cc> - country code

<nc> - network operator code

<n> - progressive number of adjacent cell

<bsic> - base station identification code

<qual> - quality of reception

0..7

<lac> - localization area code

<id> - cell identifier

<arfcn> - assigned radio channel

<dBm> - received signal strength in dBm

<timadv> - timing advance

<psc> - primary synchronisation code

<rscp> - Received Signal Code Power in dBm

<ecio> - chip energy per total wideband power in dBm

<uarfcn> - UMTS assigned radio channel

<drx> - Discontinuous reception cycle length

<scr> - Scrambling code

NOTE:

TA: **<timadv>** is reported only for the serving cell.

When the last setting done is **AT#MONI=7**, then the Read command reports the above pieces of information for each of the cells in the neighbor of the serving cell, formatting them in a sequence of **<CR><LF>**-terminated strings. Currently this is available in case of GSM network.

For example (WCDMA):

at#moni=0<cr>

OK

At#moni<cr>

#MONI: Welcome to KTF PSC:270 RSCP:-76 LAC:5121 Eclo:-3.5 UARFCN:10812 PWR:-73 dBm DRX:64

OK

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at#moni=1<cr>

OK

at#moni<cr>

#MONI: Sync NSet PSC:408 RSCP:-86 EcIo:-13.5 UARFCN:10812

#MONI: Sync NSet PSC:102 RSCP:-104 EcIo:-31.5 UARFCN:10812

OK

In this case the mobile is registered on the network whose Country code is 010 and Network operator code is 03, the signal strength is -83dBm (MMI may indicate 4 antenna bars as reported on the table 5). Other information received is strictly technical and must not be given to the user.

The values reported are random and have no meaning. They are used only to explain command usage.

NOTE:

This command must be used only to gather information on network name and signal strength, to check if mobile is registered or is looking for a suitable network to register. Always use the +CREG command. This is due to the fact that if the network signal is too weak and mobile looses the registration. Until a new network is found the #MONI command reports the last measured valid values and not the real ones.

The TA (timing advance parameter) is valid only during a call.

TIP:

To properly use this feature, check network registration with command +CREG as seen on par. 2.7.3.1 and when mobile is registered query the mobile for network operator name and signal strength with #MONI command.

4.5. Placing a Voice call

Before a voice call can be placed, it is recommended to check if the mobile is registered on a network (see par. 4.4.3.1) and if the signal strength is enough to ensure a call can be made.

4.5.1. Voice Call Device Setup

4.5.1.1. Set the Device in Voice Mode

- send command AT+FCLASS=8<cr>
- wait for OK response

NOTE:

This command may be omitted if the modifier ";" is added at the end of the ATD command after the dialed number.

4.5.1.2. Set the Desired Audio Path Active

The UC864 family has three different audio paths:

- internal microphone/ear (MT)
- external microphone/ear (HF)
- PCM microphone/ear(PCM)

Usually the internal path is used for a handset function, while the external is used for handsfree function. There are two ways to switch between these two paths:

- SOFTWARE: by using the command AT#CAP= <n> (with n=1 OR n=2)
- HARDWARE: by setting AT#CAP=0 and setting the AXE input high (internal MT) or low (external HF).

If only one path is needed, then it is preferable to use the internal one (MT).

TIP:

When Hardware control is not needed AXE pin can be left unconnected.

TIP:

The audio paths can also be switched in both ways during a call.

- send command AT#CAP=<n><cr>

where:

<n> = 0 for HARDWARE control with AXE input

<n> = 1 for external HF path (regardless of the AXE input status)

<n> = 2 for internal MT path (regardless of the AXE input status)

- wait for OK response

For example:

1 - Let us assume that the desired audio path is always the internal MT

command

AT#CAP=2<cr>

answer

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OK

2 - Let us assume that the desired audio path has to be determined by HARDWARE pin AXE

command

AT#CAP=0<cr>

answer

OK

Now set the hardware pin AXE in the desired status.

Set the desired volume on the active audio path speaker output

This setting is not strictly necessary; it is also possible to keep the default volume setting.

- send command AT+CLVL=<vol><cr>

where:

<vol> is a number between 0 and 10 representing the volume setting:

0 - minimum volume

10 - maximum volume

- wait for OK response

NOTE:

The volume setting refers to the ACTIVE path ear line and is stored each time. When changing audio path, the volume setting will be reset to the previously stored value for that audio path.

4.5.1.3. Check for Microphone Mute Setting

The microphone of the active path can be muted with an AT command; to be sure that it is not muted, it is suggested to check it with this command

- Send command AT+CMUT?<cr>
- wait for response in the format:

+CMUT: <mute>

OK

where:

<mute> is the muting setting for the microphone:

0 - microphone active

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1 - microphone muted

NOTE:

The mute setting is different from Volume setting: it refers to both the audio paths, the mute setting will remain even when changing audio path.

4.5.2. Phone Number Dialing

4.5.2.1. Dial a Given Phone Number

Send command **ATD <PhoneNumber><cr>**

where:

<PhoneNumber> is the phone number to be dialed

wait for response:

Response	Reason	Action
OK	The call has been placed	Wait for the other party to lift the receiver
BUSY	The line called is busy	retry later
NO ANSWER	The receiver did not answer the call	retry later
NO CARRIER	Call placing has not been successful	check for mobile registration and signal strength

For example:

1- Let us assume you have to call the national number 040 - 4192111,

command

ATD 0404192111<cr>

response

OK

2- Let us assume you have to call the national number but in international format +39-40-4192111,

command

ATD +39404192111<cr>

response

OK

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3- Let us assume you have to call the international number +386-40-4192111 without previously setting the +FCLASS=8 (voice),

command

ATD +386404192111;<cr>

response

OK

4.5.3. Closing the Voice Call

4.5.3.1. Hang up the Voice Call

- send command AT+CHUP<cr>
- wait for response OK

TIP:

During the voice call the device remains in command mode, so the escape sequence (+++) must not be issued before sending commands.

4.6. Placing a Circuit Switched Data (CSD) call

Before a data call can be placed, it is recommended to check if the mobile is registered on a network (see par. 2.7.3.1) and if the signal strength is enough to ensure that a call can be made.

4.6.1. CSD Call Device Setup

4.6.1.1. Set the Device in Data Mode

- send command AT+FCLASS=0<cr>
- wait for OK response

TIP:

The +FCLASS setting is maintained in the memory and there is no need to repeat this command if +FCLASS setting is not changed.

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4.6.1.2. Set the Desired Modulation and Speed for the Connection

The data connection can be made using different modulations at different speeds. This connection mode can be selected with the command **+CBST**. The syntax for the command is: **AT+CBST=<mod>,0,<ce>**

These parameters can be selected as seen in the table:

<WCDMA network>

Command	Modulation	Speed [bps]	Connection Element
AT+CBST=0,0,1	V.32	9600	non transparent
AT+CBST=14,0,1	V.34	14400	non transparent
AT+CBST=16,0,1	V.34	28800	non transparent
AT+CBST=17,0,1	V.34	33600	non transparent
AT+CBST=43,0,1	V.120	14400	non transparent
AT+CBST=48,0,1	V.120	28800	non transparent
AT+CBST=51,0,1	V.120	56000	non transparent
AT+CBST=75,0,1	V.110/ X.31	14400	non transparent
AT+CBST=80,0,1	V.110 / X.31	28800	non transparent
AT+CBST=81,0,1	V.110 / X.31	38400	non transparent
AT+CBST=83,0,1	V.110/ X.31	56000	non transparent
AT+CBST=83,4,1	V.110/ X.31	56000 RDI	non transparent
AT+CBST=84,0,1	X.31	64000	non transparent
AT+CBST=116,1,0	Bit transparent	64000	transparent
AT+CBST=134,1,0	multimedia	64000	transparent

<GSM network>

Command	Modulation	Speed [bps]	Connection Element
AT+CBST=0,0,1	V.32	9600	non transparent
AT+CBST=7,0,1	V.32	9600	non transparent
AT+CBST=12,0,1	V.34	9600	non transparent
AT+CBST=14,0,1	V.34	14400	non transparent
AT+CBST=39,0,1	V.120	9600	non transparent
AT+CBST=43,0,1	V.120	14400	non transparent
AT+CBST=71,0,1	V110/ X.31	9600	non transparent
AT+CBST=75,0,1	V.110/ X.31	14400	non transparent
AT+CBST=7,0,0	V.32	9600	transparent
AT+CBST=12,0,0	V.34	9600	transparent
AT+CBST=14,0,0	V.34	14400	transparent

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Once selected the appropriate **<mod >** and **<ce>** parameters from the table:

- send command **AT+CBST=<mod>,0,<ce><cr>**
- wait for **OK** response

4.6.2. Phone number dialing (data call)

4.6.2.1. Dial a Given Phone Number

- send command **ATD <PhoneNumber><cr>**

where:

- **<PhoneNumber>** is the phone number to be dialed
- wait for response:

Response	Reason	Action
CONNECT 9600	The called modem is now on line.	exchange data
BUSY	The line called is busy	retry later
NO ANSWER	The receiver did not answer the call	retry later
NO CARRIER	The modem handshaking has not been successful	Check for mobile registration and signal strength and eventually retry.

TIP:

The response to the ATD command is returned after the modem handshaking, this takes about 30 seconds, so allow this time before doing anything.

TIP:

When the device is doing the handshake the issue of any character closing the handshake aborts the call.

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For example:

1- Let us assume you have to call the national number 040 - 4192111,

command

ATD 0404192111<cr>

response

CONNECT 9600

2- Let us assume you have to call the national number but in international format +39-40-4192111,

command

ATD +39404192111<cr>

response

CONNECT 9600

3- Let us assume you have to call the international number +386-40-4192111,

command

ATD +386404192111<cr>

response

CONNECT 9600

4.6.3. Closing the Data call

4.6.3.1. Exit the data mode and enter the command mode

- send escape sequence **+++**
- wait for response OK

4.6.3.2. Hang up the data call

- send command ATH<cr>
- wait for response NO CARRIER

TIP:

During the data call the device remains in data (on line) mode, so the escape sequence **(+++)** must be issued before sending AT commands to the device.

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4.7. Answer an incoming Call

When an incoming call is detected, the device reports an unsolicited code, which may be:

Unsolicited code	Reason
RING	The extended format of incoming call indication is disabled and a call (voice or data) is incoming.
+CRING: VOICE	The extended format of incoming call indication is enabled and a voice call is incoming.
+CRING: ASYNC	The extended format of incoming call indication is enabled and an asynchronous transparent data call is incoming.
+CRING: REL ASYNC	The extended format of incoming call indication is enabled and an asynchronous reliable (not transparent) data call is incoming.
+CRING: SYNC	The extended format of incoming call indication is enabled and a synchronous transparent data call is incoming.
+CRING: REL SYNC	The extended format of incoming call indication is enabled and a synchronous reliable (not transparent) data call is incoming.
+CRING: FAX	The extended format of incoming call indication is enabled and a fax call is incoming.

To answer the call:

- send command **ATA<cr>**
- wait for response:

Response	Reason	Action
CONNECT 9600	The incoming call was a DATA one and called modem is now on line.	exchange data
ERROR	No incoming call is found, call may have been lost	call lost
NO CARRIER	The incoming call was a DATA one and the modem handshaking has not been successful	check for mobile registration and signal strength and modem settings.
OK	The incoming call was a VOICE call and is now active.	proceed ahead

TIP:

The call is answered with the appropriate type (VOICE or DATA) regardless of the **+FCLASS** active setting. To distinguish between Data and Voice see the command response or the extended format incoming call indication.

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3.8 Data Flow Control

The Telit UC864 family provides the flow control method to avoid the unexpected data loss, while data communication is activating via serial interface such as UART,USB.

Below table describes the flow control method can be selected in serial interface

	SW Flow control (Xon/Xoff)	HW Flow control (RTS/CTS)	No Flow control	Remark
UART1	0	0	0	Flow control method can be set by AT\Q, AT&K , AT+IFC
USB MDM		0		Only support for RTS/CTS
USB AUX			0	No support flow control

NOTE:

USB AUX doesn't support any flow control method. Therefore, this port isn't suitable for DATA service port. We recommend this port should be used only for AT command and URC processing.

In case TE sends RTS signal or XOff to Modem to stop data flow from Modem, Modem's transmission can't be stopped, instantly. There are some delay time Modem process RTS signal. Therefore, TE should prepare the guarding buffer after sending RTS signal or XOff to Modem to control data flow. Below table describes the size of guarding buffer, according to serial interface and air access technology, approximately

	GSM/WCDMA Circuit Service	GPRS/EGPRS/WCDMA Packet Service	HSDPA
UART1	1 Kbyte	1.5 Kbyte	1.5 Kbyte
USB MDM	1 Kbyte	1.5 Kbyte	4 Kbyte

TE should prepare the guarding buffer more than the recommended buffer size to guarantee their data transmission without the loss of data

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5. Advanced Operations

5.1. Accessing the Phonebook

The UC864 family can access the phonebook storage of the SIM card inserted, by using specific AT commands it is possible to store and recall phone numbers and their associated name.

5.1.1. Preliminary Phonebook Setup

The UC864 family supports several SIM phonebook storages:

- **"DC"** - MT dialed calls list (+CPBW may not be applicable for this storage)
- **"EN" - SIM/USIM** (or **MT**) emergency number (+CPBW is not be applicable for this storage)
- **"FD" - SIM/USIM** fixed dialing-phonebook. If a SIM card is present or if a UICC with an active GSM application is present, the information in EF_{FDN} under $EF_{Telecom}$ is selected. If a UICC with an active USIM application is present, the information in EF_{FDN} under ADF_{USIM} is selected.
- **"LD"** - SIM/UICC last-dialing-phonebook "MC" - MT missed(unanswered received) calls list (+CPBW may not be applicable for the storage) "ME" - MT phonebook
- **"ME"** - MT phonebook
- **"ON" - SIM(or MT)** own numbers (MSISDNs) list (reading of this storage may be available through +CNUM also). When storage information in the SIM/UICC, if a SIM card is present or if a UICC with an active USIM application is present, the information in EF_{MSISDN} under $DF_{Telecom}$ is selected. If a UICC with an active USIM application is present, the information in EF_{MSISDN} under ADF_{USIM} is selected.
- **"RC" - MT** received-calls-list (+CPBW and +CPBF are not applicable for this storage)
- **"MC" -** device missed (unanswered received) calls list (+CPBF is not applicable for this storage)
- "**MB**" - mailbox numbers stored on SIM; it is possible to select this storage only if the mailbox service is provided by the SIM (see **#MBN**).

This is the list of the received calls calling numbers, it is updated automatically at each call received and insertion or search on it is not possible. The only operations allowed are recall, read and delete.

- **"SM" - SIM/UICC** phonebook. If a SIM card is present or if a UICC with an active GSM application is present, EF_{ADN} under $DF_{Telecom}$ is selected. If a UICC with active USIM application is present, the global phonebook, $DF_{PHONEBOOK}$ under $DF_{Telecom}$ is selected.

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In order to access the storage, you have to choose which one will be active. This must be always the first PB operation. Once the storage is selected, it is not needed anymore to select it again until the desired storage remains the one active and the device is not turned off.

5.1.1.1. Selecting PB Storage Active

- send command AT+CPBS=<storage>[<,passwrod>]<cr>

where:

<storage> is the desired PB storage:

"DC" - MT dialed calls list (+CPBW may not be applicable for this storage)

"EN" - SIM/USIM (or MT) emergency number (+CPBW is not be applicable for this storage)

"FD" - SIM/USIM fixed dialing phonebook

"LD" - SIM/USIM last dialing phonebook

"MC" - missed calls list

"MB" - mailbox numbers stored on SIM

"ME" - MT phonebook

"ON" - SIM (or MT) own numbers (MSI storage may be available through +CNUM also).

"RC" - received calls list

"SM" - SIM/USIM phonebook

<password>: string type value representing the PIN2-code required when selecting PIN2-code locked <storage>s above, e.g. **"FD"** or the hidden key to be verified in order to access to the hidden phonebook entries in the SIM/USIM or any other phonebook with hidden entries.

- wait for response:

Response	Reason	Action
OK	selected PB is now active	Proceed ahead
ERROR	some error occurred	Enable extended result codes (see par. 4.4.2.1) and retry.
+CME ERROR: 10	SIM not present	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CMS ERROR: 310	SIM not present	Check SIM or require SIM

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		insertion and repeat from par. 4.4.2.2
+CME ERROR: 11	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3)
+CMS ERROR: 311	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3)
+CME ERROR: 12	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CMS ERROR: 316	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CME ERROR: 13	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CMS ERROR: 313	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CME ERROR: 14	SIM is busy	retry later
+CMS ERROR: 314	SIM is busy	retry later
+CME ERROR: 15	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).
+CMS ERROR: 315	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM)..
+CME ERROR: 17	PIN2 is required to continue operations, since FD facility is not enabled.	Enable FD facility with +CLCK (see par.5.1.1.2) and retry.

NOTE:

After power up & PIN authentication the device reads all the SIM for a backup, hence SIM access is inhibited (SIM is busy after the issue of the PIN or after power up if PIN request is disabled) for a time varying from few seconds to about a minute, depending on the percentage of written records in the SIM phonebook. If Phonebook commands are issued during this time the device returns an error message. If this happens, the operations will start again later.

NOTE:

Due to the particular features of the **FD** storage, when selecting the **FD** storage the PIN2 must be inserted or the **FD** facility must be enabled.

If **+CPBS** command reports **+CME ERROR: 17** then enable the facility with command **+CLCK** (see par. 3.1.1.2)

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For example:

1- Let us assume you want to select the "SM" normal phonebook for operations, command

AT+CPBS="SM"<cr>

response

OK

2- Let us assume you want to select the "MC" missed calls list for operations, command

AT+CPBS="MC"<cr>

response

OK

3. Let us assume you want to select the “FD” fixed dialing phonebook for operations command

AT+CPBS="FD",”0000”<cr>

response

OK

5.1.1.2. Enable Fixed Dialing Phonebook Facility (only for FD PB)

- send command AT+CLCK=FD,1,<PIN2><cr>

where:

<PIN2> is the PIN2 code of the SIM.

- wait for response:

Response	Reason	Action
OK	FD facility is now enabled	Return to select PB (see par. 5.1.1.1)
ERROR	some error occurred	Enable extended result codes (see par. 4.4.2.1), check if the PIN2 is correct and retry.
+CME ERROR: 17	the inserted PIN2 is wrong	Check PIN2 code and retry.

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NOTE:

When receiving the ERROR or +CME ERROR message, repeat Query SIM presence and status since after 3 failed attempts SIM PIN2 is not requested anymore, SIM PUK2 is requested instead. You may need to go through procedure 2.7.2.4 (but insert PUK2 instead of PUK1)

5.1.2. Phonebook Entry Search by Name

Fisrt, you must select the "SM" storage as active (see par.5.1.1.1).

- send command **AT+CPBF=<text><cr>**

where:

<text> is the desired string to be found in the name field of the PB record.

- wait for response in the format:

+CPBF= <index>,"<number>",<type>,"<text>"

OK

where:

<index> is the record number on the PB;

<Number> is the phone number;

<type> is the type of number:

145 - international numbering scheme

129 - national numbering scheme

<text> is the alphanumeric name associated with the number or in the case no corresponding entries are found:

+CME ERROR: 22 or simply **ERROR.**

NOTE:

The search for **<text>** string is not case sensitive and the string may or may not be included in double brackets.

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For example:

1- Let us assume you want to select the "SM" normal phonebook for operations,

command

AT+CPBS="SM"<cr>

response

OK

Now you might want to look for the entries with the name starting with: "FA"

command

AT+CPBF="FA"<cr>

the response may look like:

+CPBF= 7,"+39404192369",145,"Fabio"

+CPBF= 9,"0404192111",129,"Fabrizio"

OK

Now you might want to look for the entries with the name starting with: "FAUSTO" but no record contains this name:

command

AT+CPBF="FAUSTO"<cr>

response

+CME ERROR: 22

or if extended error codes are disabled simply

response

ERROR

5.1.3. Phonebook Entry Read by Index

First, you must select the desired storage as active (see par. 5.1.1.1). Then:

- send command AT+CPBR=<index>[,<index2>]<cr>

where:

<index> is the index number of the desired PB record to be read.

- wait for response in the format:

+CPBR= <index>,"<number>",<type>,"<text>"

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OK

where:

<index> is the record number on the PB;

<Number> is the phone number;

<type> is the type of number:

145 - international numbering scheme

129 - national numbering scheme

<text> is the alphanumeric name associated with the number or in the case the index number does not correspond to a written record:

+CME ERROR: 22 or simply ERROR.

For example:

1- Let us assume you want to select the "SM" normal phonebook for operations,

command

AT+CPBS="SM"<cr>

response

OK

Now you might want to look for the entry at the position index = 7

command

AT+CPBR=7<cr>

the response may look like

+CPBR= 7,"+39404192369",145,"Fabio"

OK

Now you might want to look for the entries at the positions from 7 to 9 and for example the position at index 8 is empty

command

AT+CPBR=7,9<cr>

the response may look like

+CPBR= 7,"+39404192369",145,"Fabio"

+CPBR= 9,"0404192111",129,"Fabrizio"

OK

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5.1.4. Phonebook Entry Write

First you must select the desired storage as active (see par. 5.1.1.1). Then:

- send command AT+CPBW=<index>,<number>,<type>,<text><cr>

where:

<index> is the index number of the desired PB record to be written (may be omitted if any empty record number can be used).

<Number> is the phone number;

<type> is the type of number:

145 - international numbering scheme (contains the character "+")

129 - national numbering scheme

<text> is the alphanumeric name associated with the number.

- wait for response:

Response	Reason	Action
OK	Record has been successfully written	Proceed ahead
ERROR	some error occurred	Enable extended result codes (see par. 4.4.2.1), and retry.
+CME ERROR: 10	SIM not present	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CMS ERROR: 310	SIM not present	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CME ERROR: 11	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3)
+CMS ERROR: 311	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3
+CME ERROR: 12	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CMS ERROR: 316	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CME ERROR: 13	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CMS ERROR: 313	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2

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+CME ERROR: 14	SIM is busy	retry later
+CMS ERROR: 314	SIM is busy	retry later
+CME ERROR: 15	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).
+CMS ERROR: 315	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).
+CME ERROR: 21	invalid index	Change index number or leave it empty and retry.
+CME ERROR: 20	memory full	PB storage is full.
+CMS ERROR: 322	memory full	PB storage is full.

For example:

1- Let us assume you want to select the "SM" normal phonebook for operations,

command

AT+CPBS="SM"<cr>

response

OK

Now you might want to write a new record on the PB:

command

AT+CPBW=,"0404192123",129,"NewRecord"<cr>

response

OK

Now you may want to check if the operation has really succeeded and where the new record has been written (obviously the operation was successful, since the device returned OK).

command

AT+CPBF="NEW"<cr>

response

+CPBF= 8,"0404192123",129,"NewRecord"

OK

The new record was written at the position index 8. (The first free record index found).

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5.1.5. Phonebook Entry Delete

Fisrt, the desired storage must be active (see par.5.1.1.1). Then:

- send command AT+CPBW=<index><cr>

where:

<index> is the index number of the desired PB record to be deleted.

- wait for response:

Response	Reason	Action
OK	Record has been successfully deleted	proceed ahead
ERROR	some error occurred	Enable extended result codes (see par. 4.4.2.1), and retry.
+CME ERROR: 21	invalid index, out of PB storage limits	check index number and retry.
+CME ERROR: 10	SIM not present	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CMS ERROR: 310	SIM not present	Check SIM or require SIM insertion and repeat from par. 4.4.2.2
+CME ERROR: 11	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3)
+CMS ERROR: 311	SIM is present and PIN is required to continue operations	insert SIM PIN (see par. 4.4.2.3)
+CME ERROR: 12	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CMS ERROR: 316	SIM is present and PUK is required to continue operations	insert SIM PUK (see par. 4.4.2.4)
+CME ERROR: 13	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CMS ERROR: 313	SIM defect	Check SIM insertion or require a new SIM not defected and repeat from par. 4.4.2.2
+CME ERROR: 14	SIM is busy	retry later
+CMS ERROR: 314	SIM is busy	retry later
+CME ERROR: 15	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).
+CMS ERROR: 315	SIM is wrong type	Check SIM, it must be a GSM SIM or UMTS SIM(USIM).

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TIP:

The delete operation simply overwrites the record number <index> with an empty record.

If the record to be deleted was already empty, no error messages will be shown, but it will be only filled again with empty values.

5.1.6. Phonebook Entry Dial

You may want to dial a number previously stored in the phonebook. First, you must find the desired phone number index position, to do it use **the +CPBF** command. Once the <index> number is known, set up the device for the type of call you want to dial. Then:

- send command **ATD> <index><cr>**

where:

<index> is the index number of the desired PB record to be dialed.

- wait for response according to the call type you issued.

For example:

1- Let us assume you want to make a Voice call on the internal audio path MT to "Fabio" whose number is stored on the SIM PB:

- Select the PB as active storage

command

AT+CPBS="SM"<cr>

response

OK

Now find the index number where "Fabio" is recorded:

command

AT+CPBF="Fabio"<cr>

the response may look like

+CPBF= 7,"+39404192369",145,"Fabio"

OK

the first field is the index position: 7 in this case.

Now set up Voice call:

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command

AT+FCLASS=8<cr>

response:

OK

AT#CAP=2 <cr>

OK

AT+CLVL=8<cr>

OK

AT+CMUT? <cr>

+CMUT: 0

and dial

ATD> 7<cr>

OK

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5.2. Distinguish Calls

5.2.1. Identify the Call Type

The UC864 family is able to identify the call type before answering it. It is possible to have different ring indications (unsolicited codes) depending on the call type:

Unsolicited code	Reason
RING	The extended format of incoming call indication is disabled and a call (voice or data) is incoming.
+CRING: VOICE	The extended format of incoming call indication is enabled and a voice call is incoming.
+CRING: ASYNC	The extended format of incoming call indication is enabled and an asynchronous transparent data call is incoming.
+CRING: SYNC	The extended format of incoming call indication is enabled and a synchronous transparent data call is incoming.
+CRING: REL ASYNC	The extended format of incoming call indication is enabled and an asynchronous not transparent data call is incoming.
+CRING: REL SYNC	The extended format of incoming call indication is enabled and a synchronous not transparent data call is incoming.
+CRING: FAX	The extended format of incoming call indication is enabled and a fax call is incoming.

In order to use this feature you must enable the extended format of incoming calls

5.2.1.1. Set the Extended Incoming Call Indication

- send command AT+CRC=<n><cr>

where:

<n> is the operation mode selected:

0 - extended results Disabled (device reports RING only)

1 - extended results Enabled (device reports +CRING: <type> indication)

- wait for OK response

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5.2.2. Identify the Caller

The UC864 family is able to identify the caller number and give indication of it before the call is answered. The calling number is presented after each RING or +CRING indication in the format:

+CLIP: "<number>",<type>[,"<subaddress>",<satype>[,"<alpha>"[,<CLI validity>]]]

OK

where:

<Number> is the phone number;

<type> is the type of number:

145 - international numbering scheme

129 - national numbering scheme

<subaddress> is the subaddress of the calling party

<satype> is the type of subaddress

<alpha> is an optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook;

<CLI validity> is the validity status of CLI presentation:

0 CLI valid.

1 CLI has been withheld by the originator.

2 CLI is not available due to interworking problems or limitation or originating network.

In order to use this feature you must enable the caller ID indication presentation, if feature is disabled then no CLI indication is given after the RING or +CRING code.

5.2.2.1. Set Caller line ID Indication Presentation

- send command AT+CLIP=<n><cr>

where:

<n> is the operation mode selected:

0 - Calling Line Indication Presentation Disabled

1 - Calling Line Indication Presentation Enabled

- wait for OK response

For example:

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1- Let us assume you receive a call from the national number 1234567890 and extended incoming calls indication is disabled while CLIP is enabled, you can see:

ring indication:

RING

+CLIP: "1234567890", 129

2- Let us assume you receive a call from the international number +391234567890 and extended incoming calls indication is disabled while CLIP is enabled, you can see:

ring indication:

RING

+CLIP: "+391234567890", 145

NOTE:

This does not mean that the incoming call is an international one, it simply means that the numbering scheme used to identify the caller is international.

5.2.3. Restricting Calling Line Indication

The UC864 family is able to send the calling line indication (CLI) to the other party through the network when an outgoing call is made. This indication can be restricted (CLIR) in various ways:

- CLI sent always
- CLI never sent
- CLI temporary sent (normally not sent)
- CLI temporary not sent (normally sent)

5.2.3.1. CLIR Service Status Query

- send command AT+CLIR?<cr>
- wait for response in the format: +CLIR: <n>,<m>

OK
where:

<n> is the facility status on the Mobile

0 - CLIR facility according to CLIR service network status

1 - CLIR facility active (CLI not sent)

2 - CLIR facility not active (CLI sent)

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<m> is the facility status on the Network

0 - CLIR service not provisioned (service unavailable)

1 - CLIR service provisioned (service available)

2 - unknown (e.g. no network present, etc.)

3 - CLI temporary mode presentation restricted

4 - CLI temporary mode presentation allowed

NOTE:

The <m> parameter reports the status of the service at network level.

If the CLIR service is not provisioned, then it is not possible to use this service and changing the first parameter <n> will not change the CLI presentation to the other party behavior of the network.

For example:

1- Let us assume you want to check your CLIR settings:

command

AT+CLIR? <cr>

response

+CLIR: 2,4

In this case the CLIR service is temporary mode allowed on the network and the mobile sends the CLI when calling. (CLI Restriction not active).

5.2.3.2. Restrict/Allow Caller Line ID Indication

- send command AT+CLIR=<n><cr>

where:

<n> is the operation mode selected:

0 - Calling Line Indication to the other party According to Network service status.

1 - Calling Line Indication Restriction Enabled (CLI not sent)

2 - Calling Line Indication Restriction Disabled (CLI sent)

- wait for OK response

For example:

1- Let us assume you want to disable the CLI presentation to the other party permanently:

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command

AT+CLIR=1<cr>

response:

OK

5.2.4. Call Barring Control

Call barring is a GSM/WCDMA service that allows the user to block certain types of calls:

- barring all outgoing calls
- barring outgoing International calls
- barring outgoing International calls except to home country
- barring all incoming calls
- barring incoming calls when roaming outside the home country
- all barring services (applicable only for disabling command)
- all outgoing barring services (applicable only for disabling command)
- all incoming barring services (applicable only for disabling command)

The service can be queried, enabled and disabled.

NOTE:

The call barring service is handled by the network, hence all the relative commands issue a network request and it may take several seconds to get response from the network.

Furthermore, all call barring service commands must be issued when the mobile is registered on some Network, otherwise an error code is returned (no network service).

5.2.4.1. Call Barring Service Status Query

- send command AT+CLCK=<fac>,2<cr>

where:

<fac> is the facility to be queried:

AO - Barring All Outgoing Calls

OI - Barring Outgoing International Calls

OX - Barring Outgoing International Calls except to Home Country

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AI - Barring All Incoming Calls

IR - Barring Incoming Calls when Roaming outside the home country

AB - All barring services (applicable only for disabling command)

AG - All outgoing barring services (applicable only for disabling command)

AC - All Incoming barring services (applicable only for disabling command)

PP - service Provider Personalization (refer 3GPP TS 22.022 [33])

PC - Corporate Personalization (refer 3GPP TS 22.022 [33])

PF - lock Phone to the very First inserted SIM/UICC card (also referred in the present document as PH-FSIM) (MT asks password when other than the first SIM/UICC card is inserted)

- wait for response:

Response	Reason	Action
+CLCK: 0	facility is disabled	calls are allowed
+CLCK: 1	facility is enabled	calls are barred
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax and service code
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.

NOTE:

The call barring service is handled by the network, hence all the relative commands issue a network request and it may take several seconds to have the response from the network.

Furthermore all the Barring service commands must be issued when the mobile is registered on some network, else an error code is returned (no network service).

For example:

1- Let us assume you want to check whether the incoming calls when roaming outside Home Country are barred or not:

command

AT+CLCK=IR,2<cr>

response

+CLCK: 0

In this case, the incoming (received) calls ARE NOT BARRED when in Roaming outside the Home Country.

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2- Let us assume you want to check whether the Outgoing (originated) international c alls are barred or not:

command

AT+CLCK=OI,2<cr>

response:

+CLCK: 1

In this case, the outgoing international calls ARE BARRED.

5.2.4.2. Barring/Unbarring All Incoming Calls

- send command AT+CLCK=AI,<en>,<pwd><cr>

where:

<en> is the operation selected:

0 - Call Barring Disable (Unbarring)

1 - Call Barring Enable (Barring)

<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now enabled/disabled	all incoming calls will be barred/unbarred
ERROR	some error occurred	Enable the extended error codes report (see par.4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to bar all the incoming calls and the network password of your operator is 0000:

command

AT+CLCK=AI,1,0000<cr>

response

OK

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5.2.4.3. Barring/Unbarring Incoming Calls When in International Roaming

- send command AT+CLCK=IR,<en>,<pwd><cr>

where:

<en> is the operation selected:

0 - Call Barring Disable (Unbarring)

1 - Call Barring Enable (Barring)

<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now enabled/disabled	all incoming calls when is international Roaming will be barred/unbarred
ERROR	some error occurred	Enable the extended error codes report (see par.4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to bar all the incoming calls when the mobile is roaming outside its home country and the network password of your operator is 0000:

command

AT+CLCK=IR,1,0000<cr>

response

OK

5.2.4.4. Barring/Unbarring All Outgoing Calls

- send command AT+CLCK=AO,<en>,<pwd><cr>

where:

<en> is the operation selected:

0 - Call Barring Disable (Unbarring)

1 - Call Barring Enable (Barring)

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<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now enabled/disabled	all outgoing calls will be barred/unbarred
ERROR	some error occurred	Enable the extended error codes report (see par.4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to bar all the outgoing calls (originated by mobile) and the network password of your operator is 0000:

command

AT+CLCK=AO,1,0000<cr>

response

OK

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5.2.4.5. Barring/Unbarring All Outgoing International Calls

- send command AT+CLCK=OI,<en>,<pwd><cr>

where:

<en> is the operation selected:

0 - Call Barring Disable (Unbarring)

1 - Call Barring Enable (Barring)

<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now enabled/disabled	all outgoing international calls will be barred/unbarred
ERROR	some error occurred	Enable the extended error codes report (see par.4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to bar all the outgoing international calls (originated by mobile and to a number outside the home country of the mobile) and the network password of your operator is 1234:

command

AT+CLCK=OI,1,1234<cr>

response:

OK

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5.2.4.6. Barring/Unbarring All Outgoing International Calls Except to Home Country

- send command AT+CLCK=OX,<en>,<pwd><cr>

where:

<en> is the operation selected:

0 - Call Barring Disable (Unbarring)

1 - Call Barring Enable (Barring)

<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now enabled/disabled	all outgoing international calls except to Home Country will be barred/unbarred
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to bar all the outgoing international calls except the ones towards the Home Country and the network password of your operator is 1234:

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command

AT+CLCK=OX,1,1234<cr>

response:

OK

5.2.4.7. Unbarring all the Calls

- send command AT+CLCK=AB,0,<pwd><cr>

where:

<pwd> is the network password required to change facility status

- wait for response:

Response	Reason	Action
OK	Barring is now disabled	all calls will be allowed (unbarred)
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CME ERROR: 4	operation not supported, the service required is not available	Check command syntax
+CME ERROR: 30	no network service	Check for registration (see par. 4.4.3.1) and signal strength.
+CME ERROR: 16	wrong network password	check network password and retry

For example:

1- Let us assume you want to disable all the barring services you might have previously activated and the network password of your operator is 0000:

command

AT+CLCK=AB,0,0000<cr>

response:

OK

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5.3. DTMF Tones

DTMF tones are managed by specific AT commands. These tones are generated with AT commands only during voice calls. The minimum duration of a DTMF tone can be set on 10 ms but it must be considered that this value can vary with the limitations of the network.

	Group high		
Group low	1209 Hz	1336 Hz	1477 Hz
697 Hz	1	2	3
770 Hz	4	5	6
852 Hz	7	8	9
941 Hz	*	0	#

NOTE:

The GSM/WCDMA system architecture defines that the audio signal of the DTMF tones is inserted by the network switches on commands sent by the Mobile Station (MS). Thus, the default duration parameters may vary from network to network. In case that the devices are controlled by DTMF, they become sensitive related to the duration of the tones and timing of the sequences. Dedicated investigations on the parameter settings must be made.

5.4. GSM/WCDMA Power Saving Function

The Telit UC864 family has a special function that reduces power consumption during idle time, thus allowing a longer standby time with a given battery capacity.

This function monitors the DTR line and USB VBUS line indicating that the OEM application is ready to send commands when DTR goes high (3V on UART) and USB VBUS goes low (0V on USB). If so, the OEM application is not going to send any commands and the UC864 family module can save energy by shutting down its internal serial port or USB port.

When the OEM application becomes ready again, the line DTR is tied low (0V on UART) or VBUS is tied high (5V on UART); the UC864 family detect this condition and powers up the serial port or USB port.

If the power saving function is activated, then the serial port must support the DTR line since when this line is high (Data Terminal is NOT ready) and the USB port must support the VBUS line since when this line is Low the device goes into a sleep

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condition and will not respond to commands until the DTR is tied low (Data Terminal is ready) or the VBUS is tied high.

NOTE:

To turn OFF UC864-E, first, OEM application MUST cut off supplying power to the USB_VBUS pin, then the pad ON# must be tied low for at least 2 seconds and then released.

5.4.1.1. Enabling/Disabling the Power Saving Function

- send command AT+CFUN=<fun><cr>

where:

<fun> is the power saving function mode, the supported values are:

0 - minimum functionality, NON-CYCLIC SLEEP mode: in this mode, the AT interface is not accessible.

1 - mobile full functionality with power saving disabled (factory default)

2 - disable TX

4 - disable both TX and RX

5 - mobile full functionality with power saving enabled

- wait for response:

Response	Reason	Action
OK	The power save is now active	
ERROR	some error occurred	Enable extended result codes (see par. 4.4.2.1), and retry.
+CME ERROR: 4	operation not supported	Check command syntax and <fun> value.

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5.5. Power Saving Mode

Power Saving Mode means that Device is in sleep mode with disabling the interface (UART/USB).

UC864 family makes it possible for DTE to receive the event such as incoming call/SMS/data while both DTE and Modem are in sleep mode with disabling all serial interfaces.

DTE must require below specification to achieve the reduction of power consumption.

- DSR/DTR/RTS/CTS/RI Pin control on Main UART port.
- DSR/DTR/RTS/CTS Pin emulation on Telit USB Modem port.

If DTE satisfies above requirement, UC864 family can provide the functionalities:

- Keep URC message.
- Keep Incoming data during data mode, until DTE wake up from sleep mode.
- UC864 Family help DTE to reduce their power consumption using below rules.
- Use RI on Main UART to wake up DTE from sleep mode. (DTE must always monitor RI pin during power saving mode).
- Use DTR on Main UART to place Modem in sleep mode or wake up Modem from sleep mode.
- Use RTS on Main UART to control the flow from Modem to DTE. (Hardware flow control(+IFC=2,2) must be used in power saving mode).

NOTE:

UC864-E version cannot be put in saving mode if USB_VBUS is connected, first of all, you MUST cut off supplying power to the USB_VBUS, or the module does not go in power saving mode.

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5.5.1. URC Message in Power Saving

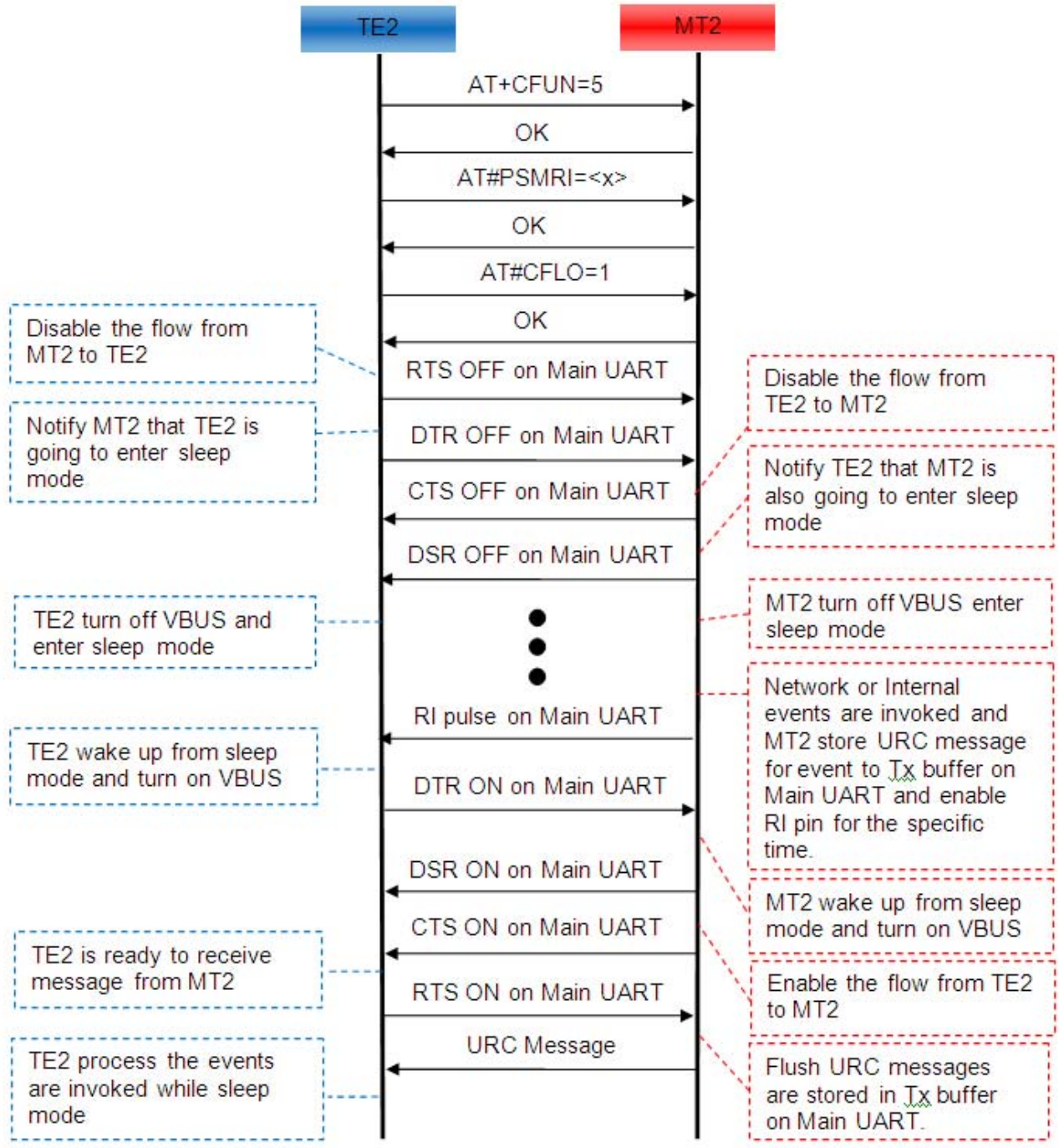
TE2
MT2
AT+CFUN=5
OK
AT#PSMRI=<x>
OK
AT#CFLO=1
OK
Disable the flow from MT2 to TE2
RTS OFF on Main UART
Disable the flow from TE2 to MT2
Notify MT2 that TE2 is going to enter sleep mode
DTR OFF on Main UART
Notify TE2 that MT2 is also going to enter sleep mode
CTS OFF on Main UART
DSR OFF on Main UART
TE2 turn off VBUS and enter sleep mode
MT2 turn off VBUS enter sleep mode
RI pulse on Main UART
Network or Internal events are invoked and MT2 store URC message for event to Tx buffer on Main UART and enable RI pin for the specific time.
TE2 wake up from sleep mode and turn on VBUS
DTR ON on Main UART
DSR ON on Main UART
MT2 wake up from sleep mode and turn on VBUS
CTS ON on Main UART
TE2 is ready to receive message from MT2
RTS ON on Main UART
Enable the flow from TE2 to MT2
URC Message
TE2 process the events are invoked while sleep mode
Flush URC messages are stored in Tx buffer on Main UART.

Figure 4.1 the flow chart for URC message in power saving mode

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Above Figure 4.1 illustrates the action flow to get URC message are invoked while both DTE and modem in sleep mode. UC864 Family offers below serial ports, which have their own the limitation for flow control methods.

Table 4.1 the flow control capability for each serial interface

Flow Control Method	Hardware Flow	Software Flow
Main UART	Support	Support
Telit USB Modem	Support(only for data mode)	Not Support
Telit USB Auxiliary	Not Support	Not Support

UC864 family keeps the URC messages are listed in Table 4.1 and enabled by AT command in power saving mode.

Table 4.2 URC message List

URC Message	Enable/Disable AT Command
RING	Not Support , Always enabled
NO CARRIER	Not Support , Always enabled
CONNECT	Not Support , Always enabled
+CIEV	+CIND
+CREG	+CREG
+CGREG	+CGREG
+CMTI,+CMT,+CBM,+CDS,+CDSI	+CNMI
+CCWA	+CCWA
#TEMPMEAS	#TEMPMON
#MWI	#MWI
#GSMAS	#GSMAD
+SRING	Not Support , Always enabled
+CRING	+CRC
+CLIP	+CLIP
+CUSD	+CUSD
+CCM	+CAOC
+CSSI,+CSSU	+CSSN
+CALA	+CALA
#QSS	#QSS
#ECAM	#ECAM

UC864 family keeps the URC messages are listed in Table 4.1 and enabled by AT command in power saving mode.

Table 3.1-3 VBUS Control System

Product	VBUS Master
UC864-E	DTE (must turn off VBUS when entering to sleep mode and turn on VBUS when waking up from sleep mode)
UC864-G/WD/WDU	Modem (turn off VBUS when entering to sleep mode and turn on VBUS when waking up from sleep mode, automatically)

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Note : DTE can get URC message using only Main UART in power saving mode. If Main UART is reserved for data communication, it's impossible to get URC messages are invoked during power saving mode. UC864 Family can't keep URC messages larger than 8K bytes, when hardware flow control is activated by RTS(AT#CFLO=1). we recommend that DTE get the URC message as soon as RI signal is guaranteed on Main UART.

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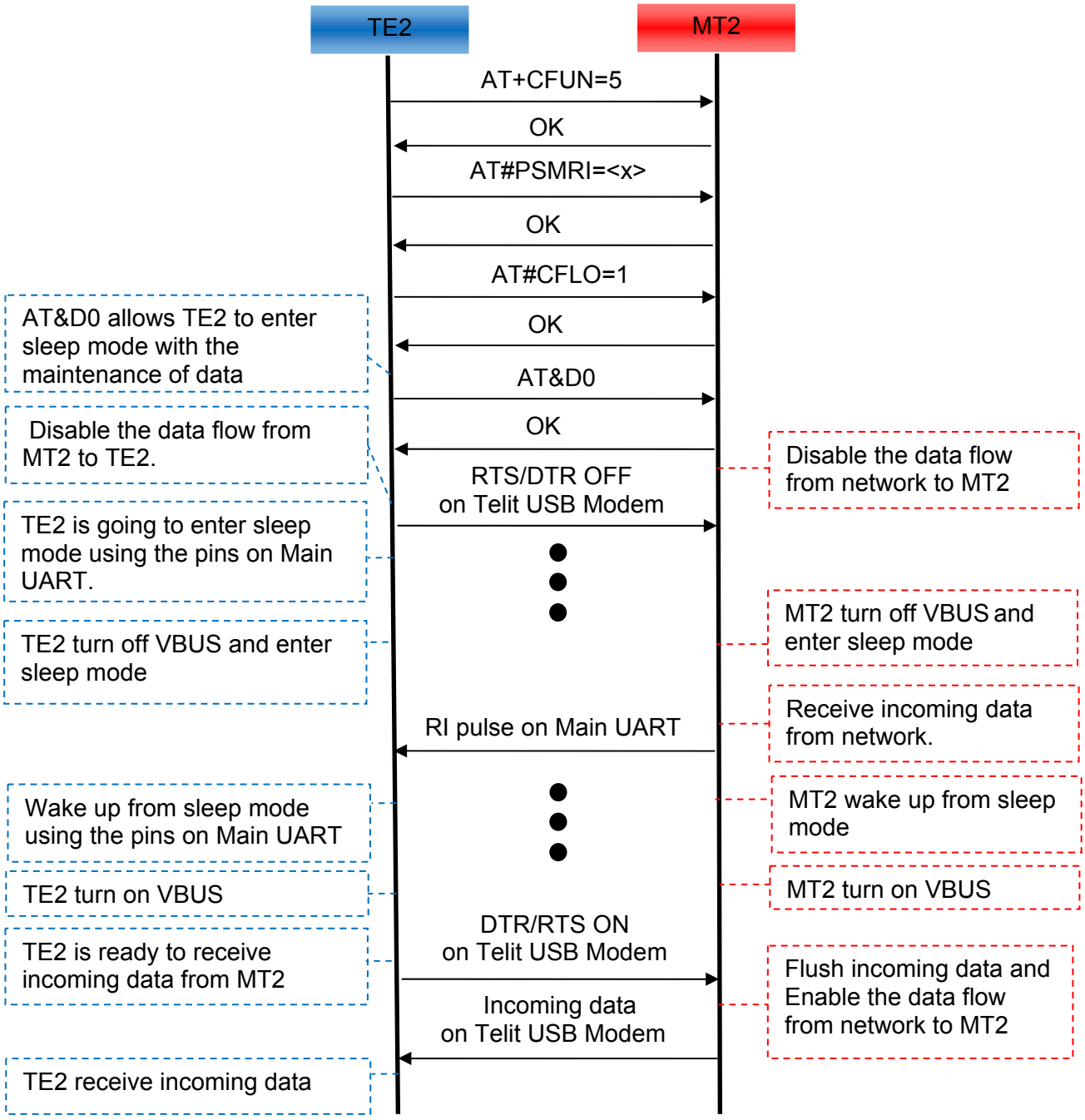
TE2
MT2
AT+CFUN=5
OK
AT#PSMRI=<x>
OK
AT#CFLO=1
OK
AT&D0
OK
RTS/DTR OFF
on Telit USB Modem
RI pulse on Main UART
DTR/RTS ON
on Telit USB Modem
Incoming data
on Telit USB Modem
AT&D0 allows TE2 to enter sleep mode with the maintenance of data
Disable the data flow from MT2 to TE2.
TE2 is going to enter sleep mode using the pins on Main UART.
TE2 turn off VBUS and enter sleep mode
Wake up from sleep mode using the pins on Main UART
TE2 turn on VBUS
TE2 is ready to receive incoming data from MT2
TE2 receive incoming data
Disable the data flow from network to MT2
MT2 turn off VBUS and enter sleep mode
Receive incoming data from network.
MT2 wake up from sleep mode
MT2 turn on VBUS
Flush incoming data and Enable the data flow from network to MT2

Figure 4.2 the flow chart for incoming data in power saving mode

UC864 family provides the option to allow DTE to enter sleep mode with the maintenance of data connection.

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Above Figure 3.2-1 illustrates the action flow to achieve this purpose.

NOTE:

This option is applied only to PS Data Service. (not support for the service such as CS Data and FAX).

NOTE:

We recommend that DTE must wake up from sleep mode and get incoming data as soon as possible. Network operators have their own inactivation timer for data transmission.

If DTE doesn't wake up from sleep mode even though RI signal is activated, the data connection may be disconnected by network.

5.5.2. RI Signal for the Specific Event

DTE can wake up from sleep mode by monitoring RI pin, while it's in sleep mode. UC864 Family provides different RI signal type to DTE, according to the specific event.

This paragraph deals with the following items:

- RI Signal for incoming call
- RI Signal for incoming SMS
- RI Signal for socket listen during server mode
- RI Signal for URC message and incoming data during power saving mode

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5.5.2.1. RI Signal for Incoming Call

RI signal for incoming call has different signal in accordance with the value of \R and RING message is sent to DTE the instance RI signal is going to is activated, periodically.

In case the value of \R is 0 or 1, RI signal and RING message like as figure 4.3 is generated.

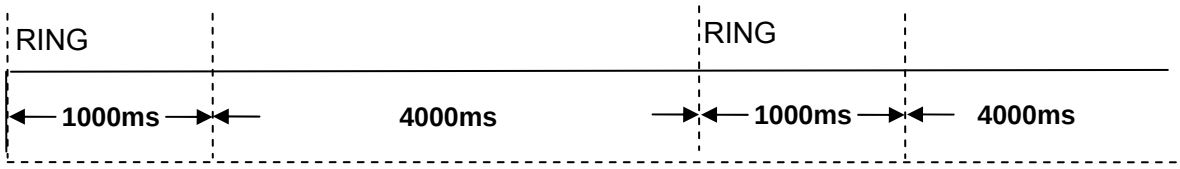

Figure 4.3 RI signal for \R0 or \R1

In case the value of \R is 2, RI signal and RING message is generated like as Figure 4.4.

Figure 4.4 RI signal for \R2

5.5.2.2. RI Signal for Incoming SMS

RI signal for incoming SMS has two types in accordance with the value of +CNMI or #E2SMSRI. In case +CNMI=3,1, the negative going pulse like as figure 4.5 is generated, one time.

Figure 4.5 RI Signal for +CNMI=3,1

In case #E2SMSRI = <x>, the negative going pulse like as figure 4.6 is generated, one time.

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Figure 4.6 RI Signal for #E2SMSRI

Note: In case both +CNMI=3,1 and #E2SMSRI=<x> is issued, RI signal behavior by #E2SMSRI is ignored by +CNMI

5.5.2.3. RI Signal for Socket Listen

RI Signal is generated, when modem receive TCP connection request from remote client during socket server mode. This signal is the negative going pulse and is generated, one time.

Figure 4.7 RI Signal for #E2SLRI

5.5.2.4. RI Signal for Events in Power Saving Mode

RI Signal for URC message and incoming data is generated, only when modem is in power saving mode. **#PSMRI** must be set as the value is not 0 and **AT#CFLO=1** must be issued. DTE issue **AT+CFUN=5** and Drop DTR pin on main UART to place modem in the power saving mode.

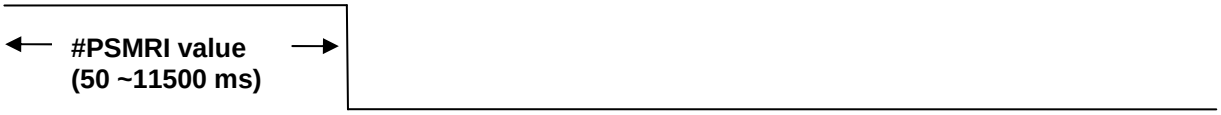

Figure 4.8 RI Signal for #PSMRI

Note: if RI signal for Incoming Call, SMS, Socket Listen and **#PSMRI** are generated at the same time in power saving mode, RI signal for **#PSMRI** will be ignored.

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5.6. SMS Handling

The Telit UC864 family supports the Short Message Service, it is possible to store, delete, write, send and receive a SMS, which is a short text message up to 160 characters long.

5.6.1. SMS Device setup

Before accessing the Short Message Service, the device has to be properly set up.

5.6.1.1. Select SMS Format Type

The UC864 family supports SMS in two different formats:

- PDU
- Text

The difference is that in the PDU mode the device returns and receives SMS encoded in the format ready to be sent to the network; in TEXT mode the device converts automatically the read PDU into text and vice versa. By using TEXT mode, the PDU data encoding knowledge is not needed and operations are easier. For this reason, we are using the TEXT mode to explain how to operate with SMS. If you are familiar with PDU encoding then you can operate with PDU by selecting that format and using appropriate command syntax.

- Send command AT+CMGF=<mode><cr>

where:

<mode> is the SMS format type:

0 - PDU

1 - Text

- wait for response OK

TIP:

This setting is stored and remains until the device is turned off. Hence, there is no need to issue it more than one time. For TEXT mode use <mode>=1.

For example:

1- Let us assume you want to set TEXT format for the SMS:

command

AT+CMGF=1<cr>

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response:

OK

5.6.1.2. Check SMS Service Centre Number

The SMS are sent by the UC864 family to a service centre (SMSC) where the message is dispatched towards its final destination or is kept until the delivery is possible. To ensure a correct behavior of this service the number of the service centre must be the one your network operator supports.

To check which number is stored as the SMSC:

- send command AT+CSCA?<cr>
- wait for response in the format: +CSCA: <number>,<type>

OK

where:

<number> is the SMSC number

<type> is the SMSC number type:

145 - international numbering scheme (number begins with "+")

129 - national numbering scheme

TIP:

This settings remains stored in the SIM card until it is changed or deleted, so this operation may be done only once if the SIM Card is not changed. The setting is maintained even after power down.

For example:

1- Let us assume you want to check your SMSC number:

command

AT+CSCA? <cr>

response:

+CSCA: +393359609600

OK

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5.6.1.3. Add SMS Service Centre Number (only if required)

If your previously check for SMSC returned an empty field:

+CSCA: ,129

Or if the SMSC number stored does not correspond to the desired one, then the new number has to be stored. In this way, the previously stored number will be overwritten.

- send command AT+CSCA=<number>,<type><cr>

where:

<number> is the desired SMSC number

<type> is the SMSC number type:

145 - international numbering scheme (number begins with "+")

129 - national numbering scheme

- wait for OK

For example:

1- Let us assume your desired SMSC number is +39335123456 (stored in international format):

command

AT+CSCA=+39335123456,145<cr>

response:

OK

5.6.1.4. Select New Messages Indication Behavior

When the device receives a new message a unsolicited indication is generated, this indication may be sent to the DTE, buffered if the DTE is busy (for example during a data call) or discarded.

To set the desired behavior:

- send command
  AT+CNMI=<mode>,<mt>,<bm>,<ds>,<bfr><cr>

where:

Set command selects the behaviour of the device on how the receiving of new messages from the network is indicated to the DTE.

Parameter:

<mode> - unsolicited result codes buffering option

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0 - Buffer unsolicited result codes in the TA. If TA result code buffer is full, indications can be buffered in some other place or the oldest indications may be discarded and replaced with the new received indications.

1 - Discard indication and reject new received message unsolicited result codes when TA-TE link is reserved, otherwise forward them directly to the TE.

2 - Buffer unsolicited result codes in the TA in case the DTE is busy and flush them to the TE after reservation. Otherwise forward them directly to the TE.

3 - if **<mt>** is set to 1 an indication via 100 ms break is issued when a SMS is received while the module is in GPRS online mode. It enables the hardware ring line for 1 s. too.

<mt> - result code indication reporting for SMS-DELIVER

0 - No SMS-DELIVER indications are routed to the TE.

1 - If SMS-DELIVER is stored into ME/TA, indication of the memory location is routed to the TE using the following unsolicited result code:

+CMTI: <memr>,<index>

where:

<memr> - memory storage where the new message is stored

"SM"

"ME"

"SR"

<index> - location on the memory where SM is stored.

2 - SMS-DELIVERs (except class 2 messages and messages in the message waiting indication group) are routed directly to the TE using the following unsolicited result code:

(PDU Mode)

+CMT: <alpha>,<length><CR><LF><pdu>

where:

<alpha> - alphanumeric representation of originator/destination number corresponding to the entry found in MT phonebook

<length> - PDU length

<pdu> - PDU message

(TEXT Mode)

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+CMT:<oa>,<alpha>,<scts>[,<tooa>,<fo>,<pid>,<dcs>, <sca>,<tosca>,<length>]<CR><LF><data> (the information written in italics will be present depending on +CSDH last setting)

where:

<oa> - originating address, string type converted in the currently selected character set (see +CSCS)

<alpha> - alphanumeric representation of <oa>; used character set must be the one selected with either command +CSCS.

<scts> - arrival time of the message to the SC

<tooa>, <tosca> - type of number **<oa>** or **<sca>**:

129 - number in national format

145 - number in international format **(contains the "+")**

<fo> - first octet of 3gpp 03.40/23.040

<pid> - Protocol Identifier

<dcs> - Data Coding Scheme

<sca> - Service Centre address, string type, converted in the currently selected character set (see +CSCS)

<length> - text length

<data> - TP-User-Data

Class 2 messages and messages in the message waiting indication group (stored message) result in indication as defined in **<mt>=1**.

3 - Class 3 SMS-DELIVERs are routed directly to **TE** using unsolicited result codes defined in **<mt>=2**. Messages of other data coding schemes result in indication as defined in **<mt>=1**.

<bm> - broadcast reporting option

0 - Cell Broadcast Messages are not sent to the **DTE**

2 - New Cell Broadcast Messages are sent to the **DTE** with the unsolicited result code:

(PDU Mode)

+CBM: <length><CR><LF><PDU>

where:

<length> - PDU length

<PDU> - message PDU

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(TEXT Mode)

+CBM:<sn>,<mid>,<dcs>,<pag>,<pags><CR><LF><data>

where:

<sn> - message serial number

<mid> - message ID

<dcs> - Data Coding Scheme

<pag> - page number

<pags> - total number of pages of the message

<data> - CBM Content of Message

<ds> - SMS-STATUS-REPORTs reporting option

0 - status report receiving is not reported to the DTE

1 - the status report is sent to the DTE with the following unsolicited result code:

(PDU Mode)

+CDS: <length><CR><LF><PDU>

where:

<length> - PDU length

<PDU> - message PDU

(TEXT Mode)

+CDS: <fo>,<mr>,<ra>,<tora>,<scts>,<dt>,<st>

where:

<fo> - first octet of the message PDU

<mr> - message reference number

<ra> - recipient address, string type, represented in the currently selected character set (see +CSCS)

<tora> - type of number <ra>

<scts> - arrival time of the message to the SC

<dt> - sending time of the message

<st> - message status as coded in the PDU

2 - if a status report is stored, then the following unsolicited result code is sent:

+CDSI: <memr>,<index>

where:

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<memr> - memory storage where the new message is stored

"SR"

<index> - location on the memory where SM is stored

<bfr> - buffered result codes handling method:

0 - TA buffer of unsolicited result codes defined within this command is flushed to the TE when **<mode>=1..3** is entered (OK response must be given before flushing the codes)

1 - TA buffer of unsolicited result codes defined within this command is cleared when **<mode>=1..3** is entered.

NOTE: Issuing **AT+CNMI<CR>** is the same as issuing the Read command.

NOTE: Issuing **AT+CNMI=<CR>** is the same as issuing the command **AT+CNMI=0<CR>**.

- wait for **OK**

TIP:

In this command description the values that are always 0 are parameter reserved for future use, in the current software revision the only value supported is 0.

For example:

1- Let us assume you want to eliminate all the unsolicited codes that may be sent when receiving SMS & Status Report:

command

AT+CNMI= 0,0,0,0,0<cr>

response:

OK

For example about a new message indication:

1- Let us assume you receive a new SMS delivery (AT+CNMI=1,1,0,0,0) and this new message is stored on the SIM "SM" storage at the location number 7; the unsolicited code you will receive (if code is enabled) is:

unsolicited code:

+CMTI: "SM",7

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2- Let us assume you receive a new SMS Status Report delivery (AT+CNMI=1,0,0,2,0) and this new message is stored on the SIM "SR" storage at the location number 8; the unsolicited code you will receive is:

unsolicited code:

+CDSI: "SR",8

5.6.1.5. Set Text Mode Parameters (only in TEXT mode)

When the device is set to operate with Text SMS not with PDU, the SMS parameters that usually reside on the header of the PDU must be set apart with the command +CSMP.

- The parameters to be set are:
- Message Format
- Validity Period
- Protocol Identifier
- Data Coding Scheme

The meaning and format of the parameters is:

Message format, like defined for the first octet of message according to GSM 3.40/23.040:

The format is an 8-bit parameter divided into 6 fields and then reported as an integer:

b7	b6	b5	b4	b3	b2	b1	b0
RP	UDHI	SRR	VPF		RD	MTI	

where

MTI message type parameter:

0 1 - SMS Submit

0 1 - SMS DELIVER

RD reject duplicates parameter

0 – do not reject duplicates SMS in SC
1 - reject duplicates on SC

VPF validity period format

0 0 - Validity period NOT present

1 0 - VP integer represented (relative)

1 1 - VP semi octet represented (absolute)

0 1 - reserved

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SRR status report request

0 - status report not requested

1 - status report requested

UDHI user data Header Information

0 - No Header on PDU

1 - Header present on PDU

RP reply path

0 - RP not set
1 - RP set

Validity Period numerical if in relative format or string if in absolute format

This parameter represents the validity period for the SMS after which the message must be disregarded instead of being delivered.

If in relative format (see VPF parameter) it is an integer:

0 to 143 - corresponding to (VP + 1) x 5 minutes

144 to 167 - corresponding to 12 hours + ((VP -143) x 30 minutes)

168 to 196 - corresponding to (VP - 166) x 1 day

197 to 255 - corresponding to (VP - 192) x 1 week

If in absolute format it is a string in the format:

"gg/MM/YY,hh:mm:ss±tz"

where

gg day of expiration (2 characters)

MM month of expiration (2 characters)

YY year of expiration (2 characters)

hh hour of expiration (2 characters)

mm minute of expiration (2 characters)

ss second of expiration (2 characters)

± sign of the time zone (+ or -)

tz time zone (2 characters)

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Protocol Identifier in numerical format: This parameter identifies the protocol used by the receiver entity and informs the SC that the conversion from SMS to that protocol must be done while delivering the message.

Protocol ID	Conversion towards
0	Implicit (default)
33	telex (or teletex reduced to telex format)
34	group 3 telefax
35	group 4 telefax
36	voice telephone (i.e. conversion to speech)
37	ERMES (European Radio Messaging System)
38	National Paging system (known to the SC)
39	Videotex (T.100/T.101)
40	teletex, carrier unspecified
41	teletex, in PSPDN
42	teletex, in CSPDN
43	teletex, in analog PSTN
44	teletex, in digital ISDN
45	UCI (Universal Computer Interface, ETSI DE/PS 3 01-3)
46-47	(reserved, 2 combinations)
48	a message handling facility (known to the SC)
49	any public X.400-based message handling system
50	Internet Electronic Mail
51-55	(reserved, 5 combinations)
56-62	values specific to each SC, usage based on mutual agreement between the SME and the SC (7 combinations available for each SC)
63	A GSM mobile station. The SC converts the SM from the received TP-Data-Coding-Scheme to any data coding scheme supported by that MS (e.g. the

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	default).
64	Short Message Type 0
65	Replace Short Message Type 1
66	Replace Short Message Type 2
67	Replace Short Message Type 3
68	Replace Short Message Type 4
69	Replace Short Message Type 5
70	Replace Short Message Type 6
71	Replace Short Message Type 7
72..94	Reserved
95	Return Call Message
96..126	Reserved
127	SIM Data download

Data coding Scheme as defined by GSM 3.38 - in numerical format The DCS is an 8-bit parameter reported as an integer, the default value is 0, otherwise for simplicity, we report only the most useful DCS, for further Schemes refer to GSM 3.38

B7	B6	b5	b4	b3	b2	b1	b0
1	1	1	1	0	Alphabet	Class	

where

Alphabet

0 - default Alphabet

1 - 8 bit

Class

0 0 - Class 0

0 1 - Class 1

1 0 - Class 2

1 1 - Class 3

TIP:

The default value for DCS = 0 represents the default SMS sent by a mobile. If you do not need any particular data coding scheme use DCS=0.

NOTE:

Not all the DCS combinations described in the 3gpp 3.38/23.038 are supported, both by the network and by the Telit UC864. Some features may be not implemented at network level or at device level, resulting in a +CMS ERROR: 303 (operation not supported) result code. If this happens then use a different DCS.

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- send command **AT+CSMP=<fo>,<vp>,<pid>,<dcs><cr>**

where:

<fo>: Message format

<vp>: Validity Period

<pid>: Protocol Identifier

<dcs>: Data coding Scheme

- wait for OK

For example:

1- Let us assume you want to set the SMS parameters to the values:

Message Format:

- SMS submit
- do not reject duplicates
- VP Format integer (relative)
- status report not requested
- No Header on PDU
- Reply path not set

Hence, the message format is the binary number 00010001 corresponding to the integer 17.

- Validity period 24 hours corresponding to an integer value 167. 12 hours + ((167 -143) x 30 min) = 24 hours
- Protocol ID implicit (SMS sent to a mobile terminal) corresponding to a value 0.
- DCS default value 0.

command

AT+CSMP= 17,167,0,0

response:

OK

2- Let us assume you want to set the SMS parameters to the values:

Message Format:

- SMS submit

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- do not reject duplicates
- VP Format semi octet (absolute)
- status report requested
- No Header on PDU
- Reply path not set

Hence, the message format is the binary number 00111001 corresponding to the integer 57.

Validity period format is absolute, hence it represents the expiration date of the message and the desired expiration date is for example 29/06/02 at 02:20 in the time zone of Italy (+1).

"29/06/02,02:20:00+1"

Protocol ID implicit (SMS sent to a mobile terminal) corresponding to a value 0.

Data Coding Scheme:

- Default Alphabet
- Class 0 (e.g. immediate display SMS)

Corresponding to the binary number 11110000 corresponding to the integer 240.

command

AT+CSMP= 57,29/06/02,02:20:00+1,0,240

response:

OK

5.6.1.6. Select SMS Memory and Check for Memory Space

There are various types of storage where the SMS can be stored, the Telit UC864 family provides two different storage:

"ME" - mobile equipment memory

"SM" - SIM Card memory

"SR" – Status report

The SMS are usually stored (this is true for both the originated and the received SMS) in the SM/ME storage.

The UC864 family allows the user to select a different storage for the read-delete, write-send, and reception-saving SMS operations.

- send command AT+CPMS=<memr>,<memw>,<mems><cr>

where:

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<memr>: memory storage for Read and Delete commands

- "SM"
- "ME"
- "SR"

<memw>: memory storage for Write and Send commands

<mems>: memory storage for new incoming message saving

- wait for response in the format:

+CPMS:<usedr>,<totalr>,<usedw>,<totalw>,<useds>,<totals>

OK

where

<usedr> - number of SMS stored into **<memr>**

<totalr> - max number of SMS that **<memr>** can contain

<usedw> - number of SMS stored into **<memw>**

<totalw> - max number of SMS that **<memw>** can contain

<useds> - number of SMS stored into **<mems>**

<totals> - max number of SMS that **<mems>** can contain

From this response you can check if the selected storage has room for new SMSs, the free positions in the storage X (where X can be r,w,s) are **<totalX> -<usedX>**.

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5.6.2. IRA Character Set

The character set used in SMS text mode is the IRA. This set defines each char as a 7-bit value, hence from 0x00 to 0x7F. The table below reports all the chars supported and their hexadecimal code. To obtain the code for a char in the table remember that in the row it is reported the least significant nibble (4 bits) and in the column the most significant nibble. The empty cells correspond to reserved combinations.

		Most Significant Nibble							
		0x	1x	2x	3x	4x	5x	6x	7x
Least Significant Nibble	x0			SP[1]	0	@	P		p
	x1			!	1	A	Q	a	q
	x2			"	2	B	R	b	r
	x3			#	3	C	S	c	s
	x4			$	4	D	T	d	t
	x5			%	5	E	U	e	u
	x6			&	6	F	V	f	v
	x7			'	7	G	W	g	w
	x8			(	8	H	X	h	x
	x9			)	9	I	Y	i	y
	xA	LF[2]		*	:	J	Z	j	z
	xB			+	;	K		k	
	xC			,	<	L		l	
	xD	CR[3]		-	=	M		m	
	xE			.	>	N		n	
	xF			/	?	O	£	o	

[1] - SP stands for space character

[2] - LF stands for Line Feed character

[3] - CR stands for Carriage Return character

For example:

1- Let us assume you want to find the IRA code for the character '&':

From the table you find:

- most significant Nibble: 2
- least significant Nibble: 6

Hence the IRA code for the '&' character is the hexadecimal 0x26.

2- Let us assume you have the IRA code 0x6B and you want to find the corresponding character:

From the table you find at the position

- most significant Nibble: 6

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- least significant Nibble: B

Hence, the character corresponding to the 0x6B IRA code is 'k'.

TIP:

With the command AT+CSCS is possible to select the character set; the available types are:

"IRA" - ITU-T.50

"8859-1" - ISO 8859 Latin 1

"PCCP437" - PC character set Code Page 437.

"UCS2" - 16-bit universal multiple-octet coded character set (ISO/IEC10646)

Please refer to the AT command specification for the full command description.

5.6.3. Writing a New SMS to Storage

A new SMS can be written in the selected storage **<memw>** (in the current SW version only "SM" is supported) and then can be sent to the desired destination.

To write the new SMS:

- send command **AT+CMGW="<da>"<cr>**

where:

<da>: destination address

- wait for prompt ">"
- send SMS text (MAX 160 characters)
- end command with CTRL-Z character (0x1A hexadecimal) or abort command with ESC character (0x1B hexadecimal)
- wait for response:

Response	Reason	Action
+CMGW: <index> OK	Message has been successfully written in position number <index>	proceed ahead
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CMS ERROR: 330	SMSC address unknown	Insert SMSC address (see par. 5.6.1.3)
+CMS ERROR: 322	Memory Full	memory is full, hence delete some records and retry.

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NOTE:

if command is aborted with ESC character, then only the OK result code is returned.

For example:

1- Let us assume you want to write a new SMS to the storage and the destination address is the number +39338123456789. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMGW="+39338123456789"

response:

>

now you can insert the message text in IRA format (note that the IRA format and ASCII format coincide for the alphabet characters but not for the other).

…here will be inserted the SMS message text…

conclude text with the character CTRL-Z

response:

+CMGW: 3

OK

In this case, the new SMS was successfully written to the location index 3 of the selected write memory.

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5.6.4. Sending an SMS Previously Stored

An already written SMS can be sent from the selected storage **<memw>**.

To send the written SMS its location index is needed:

- send command **AT+CMSS=<index><cr>**

where:

<index>: SMS location index

- wait for response:

Response	Reason	Action
+CMSS: <mr> OK	Message has been successfully sent. <mr> represents the message reference number.	proceed ahead
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CMS ERROR: 330	SMSC address unknown	Insert SMSC address (see par. 5.6.1.3)
+CMS ERROR: 41	"Temporary Failure", may be that the device is not registered on any network	Check for signal strength and network registration
+CMS ERROR: 331	No network service	Check for signal strength and network registration
+CMS ERROR: 1	Unassigned number	The destination address number does not exist. Check it and repeat command.
+CMS ERROR: 42	network congestion	Retry later
+CMS ERROR: 96	Mandatory information missing	Check for destination address in the SMS, overwrite it and retry.

For example:

1- Let us assume you want to send a SMS that was written to the storage index position number 3. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMSS=3

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response:

+CMSS: 1

OK

In this case, the SMS was successfully sent to the destination and its network message reference number is 1.

5.6.5. Sending a New SMS Without Storing It

A new SMS can be sent directly to the network without storing it.

- send command AT+CMGS="<da>"<cr>

where:

<da>: destination address

- wait for prompt ">"
- send SMS text (MAX 160 characters)
- end command with CTRL-Z character (0x1A hexadecimal) or abort command with ESC character (0x1B hexadecimal)
- wait for response:

Response	Reason	Action
+CMGS: <mr> OK	Message has been successfully sent. <mr> represents the message reference number.	proceed ahead
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CMS ERROR: 330	SMSC address unknown	Insert SMSC address (see par. 5.6.1.3)
+CMS ERROR: 41	"Temporary Failure", may be that the device is not registered on any network	Check for signal strength and network registration
+CMS ERROR: 331	No network service	Check for signal strength and network registration
+CMS ERROR: 1	Unassigned number	The destination address number does not exist. Check it and repeat command.
+CMS ERROR: 42	network congestion	Retry later
+CMS ERROR: 96	Mandatory information missing	Check for destination address in the SMS, overwrite it and

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		retry.
OK	command aborted by user	you issued a ESC char

For example:

1- Let us assume you want to directly send a new SMS to the destination address number +39338123456789. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMGS="+39338123456789"

response:

>

now you can insert the message text in IRA format (note that the IRA format and ASCII format coincide for the alphabet characters but not for the other).

…here will be inserted the SMS message text to be sent…

conclude text with the character CTRL-Z

response:

+CMGS: 4

OK

In this case, the new SMS was successfully sent to the SC and its network reference number is 4.

Do not confuse message reference with message index position, the first indicates the network reference for identifying the sent message (the eventually requested status report will have the same reference) while the second indicates the position where the message has eventually been stored in the memory.

5.6.6. Deleting an SMS

An already written/received SMS can be deleted from the selected storage.

To delete the SMS its location index is needed:

- send command **AT+CMGD=<index>[,<delflag>]<cr>**

where:

<index>: SMS location index, if <delflag> = 0

Test command shows the valid memory locations and optionally the supported values of **<delflag>**.

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<delflag>: an integer indicating multiple message deletion request as follows:

0 (or omitted) Delete the message specified in **<index>**

1 Delete all read messages from preferred message storage, leaving unread messages and stored mobile originated messages (whether sent or not) untouched

2 Delete all read messages from preferred message storage and sent mobile originated messages, leaving unread messages and unsent mobile originated messages untouched

3 Delete all read messages from preferred message storage, sent and unsent mobile originated messages leaving unread messages untouched.

4 Delete all messages from preferred message storage including unread messages.

- wait for response:

Response	Reason	Action
OK	Message has been successfully deleted.	proceed ahead
ERROR	some error occurred	Enable the extended error codes report (see par. 4.4.2.1) and retry.
+CMS ERROR: 321	Invalid memory index e.g. the given record was already empty	Check the <index> number and retry.

For example:

1- Let us assume you want to delete a previously written SMS that was written to the storage index position number 3. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMGD=3

response:

OK

In this case, the SMS was successfully deleted.

2- Let us assume you want to delete a received SMS that was stored to the index position number 7:

command

AT+CMGD=7

response:

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OK

5.6.7. Reading an SMS

A new SMS can be read with the command

- send command **AT+CMGR=<index><cr>**

where:

<index>: SMS location index

- wait for response in the format:

Output format for received messages (the information written in italics will be present depending on **+CSDH** last setting)*:*

+CMGR: <stat>,<oa>,<alpha>,<scts>[,<tooa>,<fo>,<pid>,

<dcs>,<sca>,<tosca>,<length>]<CR><LF><data>

Output format for sent messages:

+CMGR: <stat>,<da>,<alpha>[,<toda>,<fo>,<pid>,<dcs>,,

<sca>,<tosca>,<length>]<CR><LF><data>

Output format for message delivery confirm:

+CMGR: <stat>,<fo>,<mr>,,,<scts>,<dt>,<st>

where:

<stat> - status of the message

"REC UNREAD" - new received message unread

"REC READ" - received message read

"STO UNSENT" - message stored not yet sent

"STO SENT" - message stored already sent

<fo> - first octet of the message PDU

<mr> - message reference number

<scts> - arrival time of the message to the SC

<dt> - sending time of the message

<st> - message status as coded in the PDU

<pid> - Protocol Identifier

<dcs> - Data Coding Scheme

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<oa> - Originator address, string type represented in the currently selected character set (see **+CSCS**)

<da> - Destination address, string type represented in the currently selected character set (see **+CSCS**)

<alpha> - string type alphanumeric representation of **<da>** or **<oa>**, corresponding to an entry found in the phonebook; used character set is the one selected with command **+CSCS**. *NB: this optional field is currently not supported.*

<sca> - Service Centre number

<tooa>,<toda >,<tosca> - type of number **<oa>**,**<da>**,***<sca>***

129 - number in national format

145 - number in international format (contains the "**+**")

<length> - text length

<data> - TP-User_data

If **<dcs>** indicates that GSM03.38 default alphabet is used , each character of GSM alphabet will be converted into current TE character set (see **+CSCS**)

If **<dcs>** indicates that 8-bit or UCS2 data coding scheme is used, each 8-bit octet will be converted into two IRA character long hexadecimal number (e.g. octet 0x2A will be converted as two characters 0x32 0x41)

Note: in both cases if status of the message is 'received unread', status in the storage changes to 'received read'. An error result code is sent on empty record **<index>**.

For example:

1- Let us assume you want to read the SMS that is stored at the position index 4. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMGR=4

response:

+CMGR: "STO UNSENT","+393351234565"

Telit Test Message for Text Mode SMS.

OK

In this case the SMS was successfully read, the text contained was:

"Telit Test Message for Text Mode SMS."

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The message was written to the storage by user (STO) but still not sent (UNSENT) to the destination address with the number +393351234565

2- Let us assume you want now to read the SMS that is stored at the position index 5:

command

AT+CMGR=5

response:

+CMGR: "REC UNREAD","+393381234567890", ,"29/06/01,12:30:04+01"

Telit Test Message for Text Mode SMS RECEIVING.

OK

In this case the SMS was successfully read, the text contained was:

"Telit Test Message for Text Mode SMS RECEIVING."

The message was received (REC) from the number +393381234567890 at 12:30:04 the day 29/06/01 in the European time zone +1. After this read command the message at index 5 becomes REC READ.

5.6.8. Listing a Group of SMSs

The SMS can be grouped into 5 different groups depending on their status:

- REC UNREAD received messages still not read
- REC READ received messages already read
- STO UNSENT written messages not yet sent
- STO SENT written messages already sent
- ALL all types of messages

It is possible to have the list of all the messages in one group:

- send command AT+CMGL=<stat><cr>

where:

<stat> - status group of the message

"REC UNREAD" - new message

"REC READ" - read message

"STO UNSENT" - stored message not yet sent

"STO SENT" - stored message already sent

"ALL" - all messages

- wait for response in the format:

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For every message in the group:

+CMGL: <index>,<stat>,<oa/da> [,,,<tooa/toda>,<length>]

<CR><LF><text>

where:

<index> - message index position on the storage

<stat> - status of the message

"REC UNREAD" - new message

"REC READ" - read message

"STO UNSENT" - stored message not yet sent

"STO SENT" - stored message already sent

<oa/da> - sender number/destination number

<tooa/toda> - type of number <oa/da>

145 - international number (contains "+" character)

129 - national number

<length> - length of the message text in characters

<text> - message text

Note: If status of the message is 'received unread', status in the storage changes to 'received read'.

For example:

1- Let us assume you want to list all the SMS received read that are stored. We suppose you already have set up the device for text SMS mode as described on the previous paragraphs:

command

AT+CMGL="REC READ"

response:

+CMGL: 5, "REC READ","+393381234567890"

Telit Test Message for Text Mode SMS RECEIVING.

+CMGL: 8, "REC READ","+393381234567890"

Telit Second Test Message for Text Mode SMS RECEIVING.

OK

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In this case the SMS group was successfully read, the messages Received UNREAD were two in the position indexes 5 & 8. The optional parameters **<tooa/toda>** and **<length>** were not shown.

5.7. Using General Purpose Input/Output pins

The Telit UC864 family provides various General Purpose Input/Output pins, these pins can be configured via AT commands as Inputs, Outputs and two of them as "alternate function".

The "alternate function" are supported by pins GPIO5, which can be configured to become a RF Transmission monitor output pin that reflects the RF transmission activation, GPIO6, which can be configured to become an alarm output pin that reflects the alarm status, and GPIO7 which can be configured to become a buzzer output pin.

With these pins your application can control external hardware directly using the Telit UC864 family pins, with little or even no hardware added.

5.7.1. GPIO pin setup

Before using the GPIO pin, you must configure them to select their direction or alternate function

5.7.1.1. Setting GPIO pin as OUTPUT

When you set a GPIO as output, you must specify also the value that the pin output must take:

- send command **AT#GPIO=<pin>,<value>,1<cr>**

where:

<pin> is the GPIO pin number at which the command applies:

1 - GPIO1	12 - GPIO12
2 - GPIO2	13 - GPIO13
3 - GPIO3	14 - GPIO14
4 - GPIO4	15 - GPIO15
5 - GPIO5	16 - GPIO16
6 - GPIO6	17 - GPIO17
7 - GPIO7	18 - GPIO18
8 - GPIO8	19 - GPIO19
9 - GPIO9	20 - GPIO20

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10 - GPIO10	21 - GPIO21
11 - GPIO11	22 - GPIO22

<value> is the GPIO pin value that the pin will assume:

0 - LOW

1 - HIGH

- wait for response **OK**

NOTE:

The **#GPIO** setting is not saved and will be lost on power off, so at start-up repeat pin initialization commands. At start-up the setting for GPIO6 and GPIO7 instead is maintained even after a shutdown to permit alarm & buzzer feature to work always.

For example:

1- Let us assume you want to set GPIO3 pin as Output and you want it to be in LOW status:

command

AT#GPIO=3,0,1<cr>

response:

OK

In this case, the GPIO3 pin was successfully put in output direction and its status has been set to LOW.

5.7.1.2. Setting GPIO pin as INPUT

When you set a GPIO as input, you must specify also a dummy value for the pin state:

- send command **AT#GPIO=<pin>,<dummy_value>,0<cr>**

where:

<pin> is the GPIO pin number at which the command applies:

1 - GPIO1	12 - GPIO12
2 - GPIO2	13 - GPIO13
3 - GPIO3	14 - GPIO14
4 - GPIO4	15 - GPIO15
5 - GPIO5	16 - GPIO16
6 - GPIO6	17 - GPIO17

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7 - GPIO7	18 - GPIO18
8 - GPIO8	19 - GPIO19
9 - GPIO9	20 - GPIO20
10 - GPIO10	21 - GPIO21
11 - GPIO11	22 - GPIO22

<value> is a dummy value can be either:

0 - dummy value

1 - dummy value

- wait for response **OK**

NOTE:

The **#GPIO** setting for all GPIO except from GPIO6, GPIO7, is not saved and will be lost on power off, so at start-up repeat pin initialization commands.

At start-up all the GPIOs except from GPIO6 & GPIO7 are configured by default as INPUT, but the setting for GPIO6 and GPIO7 instead is maintained even after a shutdown to permit alarm & buzzer feature to work always.

For example:

1- Let us assume you want to set GPIO4 pin as Input:

command

AT#GPIO=4,0,0<cr>

response:

OK

In this case, the GPIO4 pin was successfully put in input direction.

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5.7.2. GPIO pin use

After having set-up the GPIO pin direction you can query the input status of an INPUT pin or set the output status of an OUTPUT pin.

5.7.2.1. Querying GPIO pin status

To query for the pin status:

- send command **AT#GPIO=<pin>,2<cr>**

where:

<pin> is the GPIO pin number at which the command applies:

1 - GPIO1	12 - GPIO12
2 - GPIO2	13 - GPIO13
3 - GPIO3	14 - GPIO14
4 - GPIO4	15 - GPIO15
5 - GPIO5	16 - GPIO16
6 - GPIO6	17 - GPIO17
7 - GPIO7	18 - GPIO18
8 - GPIO8	19 - GPIO19
9 - GPIO9	20 - GPIO20
10 - GPIO10	21 - GPIO21
11 - GPIO11	22 - GPIO22

- wait for response in the format:

#GPIO: <dir>,<stat>

OK

where:

<dir> - GPIO<pin> direction setting

<stat> - status of the pin

0 - LOW

1 – HIGH

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NOTE:

In case the GPIO pin direction is set to ALTERNATE FUNCTION (2), then the reported <stat> has no meaning and must not kept as valid, but must be threaten as a dummy value.

TIP:

The query reports depending on the pin direction:

- the read pin status in case the direction is input;

- the previously set pin status in case the direction is output.

In any case, you can know if the pin at the query moment is high or low and the pin direction.

For example:

1- Let us assume you want to query the GPIO3 pin for its status:

command

AT#GPIO=3,2<cr>

response:

#GPIO: 0,1

OK

In this case, the GPIO3 pin was set in input direction and its status has been measured to be HIGH.

2- Let us assume you want to query the GPIO4 pin for its status:

command

AT#GPIO=4,2<cr>

response:

#GPIO: 1,0

OK

In this case, the GPIO4 pin was set in output direction and its status is LOW.

3- Let us assume you want to query the GPIO6 pin for its status:

command

AT#GPIO=6,2<cr>

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response:

#GPIO: 2,0

OK

In this case, the GPIO6 pin was set in "alternate function" direction and therefore works as alarm output. The reported status = LOW has no meaning.

5.7.2.2. Setting GPIO Pin Output Status

To set the pin status (when pin is set as OUTPUT):

- send command AT#GPIO=<pin>,<value>,1<cr>

where:

<pin> is the GPIO pin number at which the command applies:

1 - GPIO1	12 - GPIO12
2 - GPIO2	13 - GPIO13
3 - GPIO3	14 - GPIO14
4 - GPIO4	15 - GPIO15
5 - GPIO5	16 - GPIO16
6 - GPIO6	17 - GPIO17
7 - GPIO7	18 - GPIO18
8 - GPIO8	19 - GPIO19
9 - GPIO9	20 - GPIO20
10 - GPIO10	21 - GPIO21
11 - GPIO11	22 - GPIO22

<value> is the pin value to be set and can be:

0 - LOW

1 - HIGH

- wait for response OK

For example:

1- Let us assume you want to set the GPIO3 pin HIGH:

command

AT#GPIO=3,1,1<cr>

response:

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OK

In this case, the GPIO3 pin was set in output direction and its status has been set to HIGH.

5.7.2.3. Using GPIO5 Pin as RFTXMON OUTPUT (alternate function)

When you set the GPIO5 pin as RFTXMON output function, the pin reports the Transmitter active status. To set the pin in alternate function you must specify also a dummy value for the pin state:

- Send command AT#GPIO=5,<dummy_value>,2<cr>

where:

<value> is a dummy value can be either:

0 - dummy value

1 - dummy value

- wait for response OK

TIP:

Remember that the alternate function places the GPIO5 pin always in OUTPUT direction.

NOTE:

The #GPIO5 direction setting is saved and will be kept after a power off.

The saving can be applied only for the alternate mode.

For example:

1- Let us assume you want to set GPIO5 pin as RFTXMON OUTPUT:

command

AT#GPIO=5,0,2<cr>

response:

OK

In this case, the GPIO5 pin was successfully put in RFTXMON output direction.

5.7.2.4. Using GPIO6 pin as ALARM OUTPUT (alternate function)

When you set the GPIO6 pin as alarm output function, the pin reports the alarm state following the +CALA settings. To set the pin in alternate function you must specify also a dummy value for the pin state:

- send command AT#GPIO=6,<dummy_value>,2<cr>

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where:

<value> is a dummy value can be either:

0 - dummy value

1 - dummy value

TIP:

Remember that the alternate function places the GPIO6 pin always in OUTPUT direction and since the GPIO6 pin value is controlled by the internal software, the corresponding function (+CALA) must be setup properly.

NOTE:

The #GPIO6 direction setting is saved and will be kept after a power off.

- wait for response **OK**

For example:

1- Let us assume you want to set GPIO6 pin as ALARM OUTPUT:

command

AT#GPIO=6,0,2<cr>

response:

OK

In this case, the GPIO6 pin was successfully put in alarm output direction.

5.7.2.5. Using GPIO7 pin as BUZZER OUTPUT (alternate function)

When you set the GPIO7 pin as buzzer output function, the pin will output a waveform suitable to drive a Buzzer, provided a simple external mosfet driver is developed and that the #SRP settings are adequate. To set the pin in alternate function you must specify also a dummy value for the pin state:

- send command **AT#GPIO=7,<dummy_value>,2<cr>**

where:

<value> is a dummy value can be either:

0 - dummy value

1 - dummy value

- wait for response **OK**

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TIP:

Remember that the alternate function places the GPIO7 pin always in OUTPUT direction and since the GPIO7 pin value is controlled by the internal software, the corresponding function (#SRP) must be setup properly.

NOTE:

The #GPIO7 direction setting is saved and will be kept after a power off.

For example:

1- Let us assume you want to set GPIO7 pin as BUZZER OUTPUT:

command

AT#GPIO=7,0,2<cr>

response:

OK

In this case, the GPIO7 pin was successfully put in buzzer output direction.

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5.8. Clock/Alarm Function

The Telit UC864 family provides a Real Time Clock and Alarm embedded in the product; it is therefore possible to set-up the proper time, check the actual time, set-up an alarm time at which the alarm will be triggered with various behavior depending on the +CALA setting.

The only requirement is that the power input to the Telit UC864 family has to be guaranteed without interruptions, the Telit UC864 family has no backup battery; therefore it will lose the time setting if its power supply is interrupted.

On Alarm trigger the Telit UC864 family can:

- automatically Wake-up fully operative from shutdown as if the ON/OFF
- automatically Wake-up from shutdown in a special status namely "alarm status" where it will not look for or try to register into any network, as if it would be off, except from the fact that it proceeds with the alarm action and it can receive commands to return completely operative or shutdown immediately.
- If already ON at alarm trigger time, simply proceed with the Alarm action

Once Woken-up the Telit UC864 family proceeds with the chosen action that can be

- issue an unsolicited code "+ALARM: <user_text>" on the serial port until a 90s timeout expires or a special Wake-up command is received
- play an Alarm tone until a 90s timeout expires or a special Wake-up command is received
- rise the pin GPIO6 until a 90s timeout expires or a special Wake-up command is received
- any combination of these actions

With these features, the Telit UC864 family for example can:

- Wake-up itself and its controlling hardware by using the GPIO6 pin at the desired time, so timely surveys can be programmed without the need to keep the any hardware on and therefore reducing power consumption to a minimum.
- Activate some special hardware on time trigger event with the GPIO6 pin.
- Alert the controlling application that the alarm time has come with the unsolicited code "+ALARM:<user_text>".
- Alert the user with the alarm tone played.

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5.8.1. Clock Date/Time

Before using the Alarm feature, you must regulate the internal clock.

5.8.1.1. Regulate the Clock

- send command AT+CCLK="<time>"<cr>

where:

<time> - current time as quoted string in the format : "yy/MM/dd,hh:mm:ss±zz"

yy - year (two last digits are mandatory), range is 00..99

MM - month (two last digits are mandatory), range is 01..12

dd - day (two last digits are mandatory), range is 01..31 (if the month MM has less than 31 days, the clock will be set for the next month)

hh - hour (two last digits are mandatory), range is 00..23

mm - minute (two last digits are mandatory), range is 00..59

ss - seconds (two last digits are mandatory), range is 00..59

±zz - time zone (indicates the difference, expressed in quarter of an hour, between the local time and GMT; two last digits are mandatory), range is -47..+48

Note: If the parameter is omitted the behaviour of Set command is the same as Read command.

- wait for response OK

TIP:

Remember that the string time has to be encapsulated in double brackets.

NOTE:

The time will start immediately after the time setting command.

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For example:

1- Let us assume you want to regulate your clock to 7 November 2002 at 12h 24m 30s for the time zone +01h central Europe:

command

AT+CCLK="02/11/07,12:24:30+04"<cr>

response:

OK

In this case, the time was successfully set.

5.8.1.2. Read the Current Date/Time

- send command AT+CCLK?<cr>
- wait for response in the format:

+CCLK: <time>

OK

Note: the three last characters of <time> are not returned by +CCLK? because the ME doesn't support time zone information.

For example:

1- Let us assume you want now to read the current time:

command

AT+CCLK?<cr>

response:

+CCLK="02/11/07,12:26:47"<cr>

OK

In this case the current date/time is: 7 November 2002 12h 26m 47s

5.8.2. Alarm Function

Once the current time has been set, the alarm function can be setup.

5.8.2.1. Regulate the Alarm Time & Behavior

- send command AT+CALA="<time>",0,<type>,"<text>"<cr>

where:

<time> is the Alarm time string in the same format of the clock setting command

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yy/MM/dd,hh:mm:ss±zz

where:

yy: two digits year (00-99)

MM: two digits month (01-12)

dd: two digits day (01-31)

hh: two digits hour (00-24)

mm: two digits minute (00-60)

ss: two digits seconds (00-60)

±zz: signed two digits timezone (-11 - +11)

<type> is the Alarm behavior:

0 - reserved for other equipment use.

1 - the MODULE simply wakes up fully operative as if the ON/OFF button had been pressed. If the device is already ON at the alarm time, then it does nothing.

2 - the MODULE wakes up in "alarm mode" if at the alarm time it was off, otherwise it remains fully operative. In both cases the MODULE issues an unsolicited code every 3s:

+ALARM: <text>

where:

<text> is the **+CALA** optional parameter previously set.

The device keeps on sending the unsolicited code every 3s until a **#WAKE** or **#SHDN** command is received or a 90s timeout occurs. If the device is in "alarm mode" and it does not receive the **#WAKE** command within 90s then it shuts down. (default)

3 - the MODULE wakes up in "alarm mode" if at the alarm time it was off, otherwise it remains fully operative. In both cases the MODULE starts playing the alarm tone on the selected path for the ringer (see command **#SRP**)

The device keeps on playing the alarm tone until a **#WAKE** or **#SHDN** command is received or a 90s timeout occurs. If the device is in "alarm mode" and it does not receive the **#WAKE** command within 90s then it shuts down.

4 - the MODULE wakes up in "alarm mode" if at the alarm time it was off, otherwise it remains fully operative. In both cases the MODULE brings the pin **GPIO6** high, provided its **<direction>** has been set to alarm output, and keeps it in this state until a **#WAKE** or **#SHDN** command is received or a 90s timeout occurs. If the device is in "alarm mode" and it does not receive the **#WAKE** command within 90s then it shuts down.

5 - the MODULE will make both the actions as for **<type>=2** and **<type>=3**.

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6 - the MODULE will make both the actions as for **<type>=2** and **<type>=4**.

7 - the MODULE will make both the actions as for **<type>=3** and **<type>=4**.

8 - the MODULE wakes up in "alarm mode" if at the alarm time it was off, otherwise it remains fully operative. In both cases the MODULE sets **High** the **RI** output pin. The **RI** output pin remains **High** until next **#WAKE** issue or until a 90s timer expires. If the device is in "alarm mode" and it does not receive the **#WAKE** command within 90s. After that it shuts down.

<text> - unsolicited alarm code text string. It has meaning only if **<type>** is equal to 2 or 5 or 6.

- Wait for response OK

NOTE:

If you use the GPIO6 pin as ALARM OUTPUT, then you MUST set its direction to "alternate function" (see par. 3.7.2.4) otherwise the pin does not respond to the alarm settings.

In case the alarm mode is equal to 1,3,7 then a dummy empty text is inserted **""**.

NOTE:

If you use the unsolicited codes **+ALARM: <text>**, then you must fix the port speed rate (see par. 2.7.1) and store it in the active profile (see command &W), in order to make the Telit UC864 family boot with the desired port speed, otherwise at the alarm wakeup, the module starts with the default port speed that may differ from yours.

TIP:

Remember that the string time has to be encapsulated in double brackets, furthermore the Alarm time is computed for different time zone, therefore the alarm time always refers to the same time zone as the clock setting regardless the time zone set in the +CALA command.

5.8.2.2. Stop the Alarm Activity

When the alarm time expires, the module starts the alarm activity according to the alarm behavior parameter **<type>** selected.

To stop the Alarm activity there are three ways, you can either decide to exit from alarm and shutdown the device or exit from alarm and entering the normal operational status; otherwise you can leave the alarm go on until the 90s timeout is reached.

5.8.2.2.1. Exit from the alarm status and shutdown

- send command **AT#SHDN<cr>**

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- wait for response OK

At the OK result code, the device will end alarm activity and shutdown.

5.8.2.2.2. Exit from the alarm status and enter the normal operating mode

- send command AT#WAKE=0<cr>
- wait for response OK

At the OK result code, the device will end alarm activity and enter normal operating mode. If the device was already in normal operating mode (alarm has started when the module was already ON), then with the command only the alarm activity is terminated.

5.8.2.3. Querying the Alarm Status

When the device awakes by means of an alarm time expire, the module starts the alarm activity but not the network activity, permitting some operations to be done by the controlling application without registering the mobile in the network.

To check if the mobile is in the "alarm status" and therefore no network activity is done or if the device is in normal operating status:

- send command AT#WAKE?<cr>
- wait for response in the format:

+WAKE: <status>

OK

where:

<status> is the operating mode:

0 - normal operating mode

1 - alarm mode

NOTE:

If the device is in the alarm mode no network activity is done, therefore the only commands that are accepted are the #WAKE and #SHDN ones.

When in the alarm mode, no operation is allowed towards the network, therefore it is not possible to receive or send calls, SMS and whatever WCDMA/GSM/GPRS services.

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5.8.2.3.1. Alarm operation example

For example:

1- Let us assume you have a battery powered device, a meteorological unit that measures every hour the conditions and therefore needs to send a new SMS every hour to the central server, for example indicating the whether status just measured. Let say your application must consume the absolute minimum power to achieve the job, since it will be placed in a remote position where its battery must last as long as possible and therefore it must shutdown completely and wake up every hour for just the time needed to measure & send the whether, successively shutdown.

set up the time in the internal clock (only the first time)

command

AT+CCLK="02/11/07,12:24:30+01"<cr>

response

OK

set up the next alarm in order to raise the GPIO6 pin to power up the controlling application too.

command

AT+CALA="02/11/07,13:24:30+01",0,6,"TIME TO MEASURE & SMS...!"<cr>

response

OK

- shutdown the UC864 family and successively the controlling application.

command

AT#SHDN<cr>

response

OK

... after an hour..

The UC864 family will turn itself ON in "Alarm Mode" and contemporarily both rise the GPIO6 pin which turns on the power to the controlling application and issue every 3s an unsolicited code +ALARM: TIME TO MEASURE & SMS...!

turn on the keep alive line in the controlling application that keeps itself ON.

stop the alarm activity in the UC864 family (recognized by the +ALARM unsolicited code) and bring the UC864 family in operating mode

command

AT#WAKE=0<cr>

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response

OK

take the whether measure

send the SMS with the whether data (see Sending a New SMS Without Storing It par. 5.6.5RMAT {Sending a New SMS Without Storing It} par. 5.6.5).

read the current time.

command

AT+CCLK?<cr>

response

+CCLK="02/11/07,13:24:47"<cr>

OK

calculate & set up the next alarm in order to raise the GPIO6 pin to power up the controlling application too.

command

AT+CALA="02/11/07,14:24:47+01",0,6,"TIME TO MEASURE & SMS...!"<cr>

response

OK

shutdown the UC864 family and successively the controlling application.

command

AT#SHDN<cr>

response

OK

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6. Packet Switched Data operations

6.1. Introduction

The Packet Switched Data(PSD) connection on GPRS, EDGE, WCDMA and HSDPA network permits DATA transfers in a completely different way with respect to previous point to point communications made with Circuit Switch Data (CSD) connection on GSM and WCDMA network.

In CSD operations the modem establishes a connection with the other party (another modem) in such a way that all the Network devices in between are transparent to the data exchanged, simulating a real point to point connection, just as if the other party is directly connected with the controlling application of the modem. The other party can be either an Internet Service Provider (ISP) or a private server, but in any case, the arrival point must have a modem to connect to (Landline, ISDN or GSM/WCDMA CSD). The connection establishment procedure defines a particular path where all the information exchanged between the two peers flows and this path is reserved for exclusive use of these 2 peers for all the time the connection is active.

This approach has the drawbacks of a long time to set-up the link between the two peers (up to a minute) and a time counting bill which proceeds even if no data is exchanged because the path resources are reserved anyway; furthermore the speed of the data transfer is limited to 14400 bps.

An example of this kind of operation is shown in the following picture, where the point to point connection is between the two peers as if all the devices inside the dashed line are not present:

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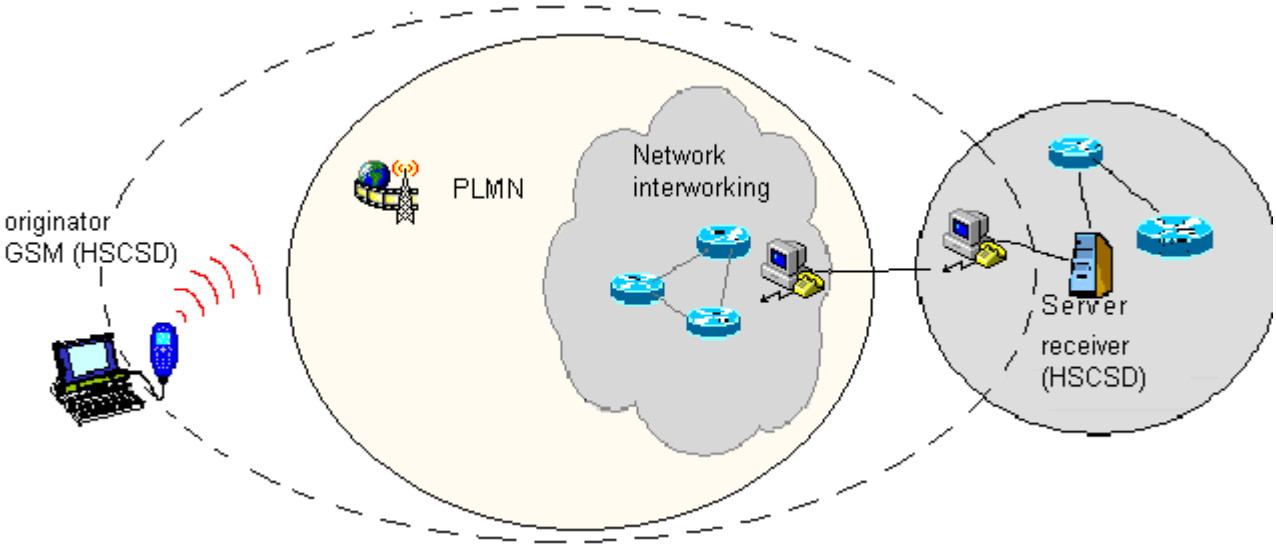
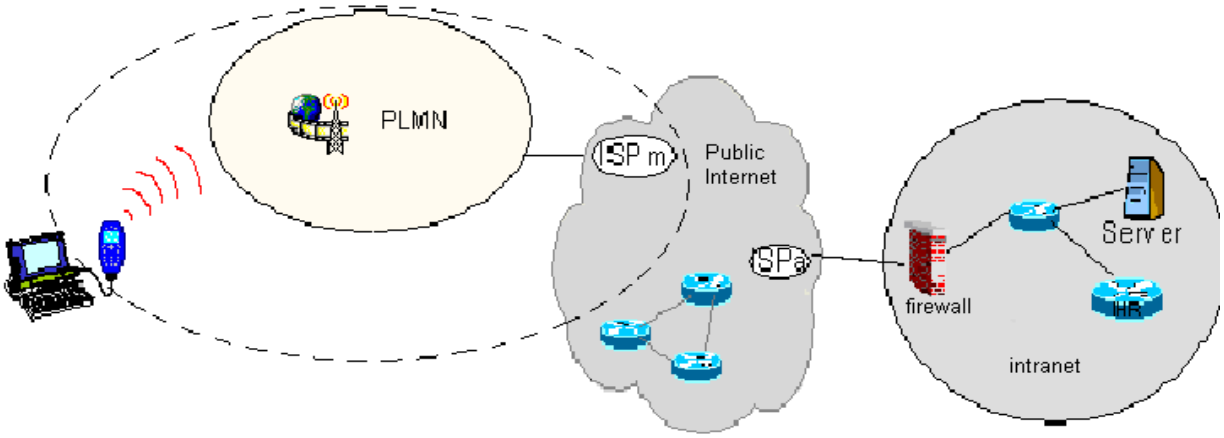


Wireless Cellular CSD interconnectivity

In PSD operations instead, the connection is made directly towards internet as if the PSD modem which support GPRS/EDGE/WCDMA/HSDPA was a network IP socket interface. There is no data path reserved for the data exchange between the two peers, instead the resources are allocated dynamically on demand and the data exchanged is organized into packets typically TCP/IP, furthermore the maximum transfer speed can be much faster than GSM CSD.

An example of PSD connection is shown in the following picture, where the PSD connection is between the PSD modem and the internet as if all the devices inside the dashed line are not present:



Wireless Cellular PSD *interconnectivity*

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Due to this kind of connection, when activating the PSD connection you must provide the network parameters to enter through the internet point of the GPRS/EDGE/WCDMA/HSDPA network ISP (Internet Service Provider) and not the phone number to be dialed. Therefore, it is not possible to establish a direct point-to-point PSD connection between two modems as in CSD case. instead an internet tunneling must be done to achieve a point to point connection between two peers.

This approach as the immediate advantage of projecting the controlling application of the PSD modem directly on the internet, ready to be accessed virtually from anywhere in the world at the same cost on the GPRS/EDGE/WCDMA/HSDPA network. Actually the billing of the PSD connection is based on the amount of data exchanged (number of packets transferred) independently from the time the connection is active or where these packet must be delivered. Therefore, it is possible to leave the controlling application always connected and ready to receive/send data on demand, while paying only for the data really exchanged.

The drawback of the PSD connection is that the controlling application must have its own TCP/IP protocol stack embedded to decode the packets that arrive from GPRS/EDGE/WCDMA/HSDPA network and encode the ones to be sent through the internet.

There are few considerations than must be done on the PSD connections:

- the GPRS connection speed with a GPRS class 12 multislot device is asymmetrical, 4 time slots in reception (80000 bps max in CS4), 4 time slot in sending (80000 bps max in CS4) and 5 time slot in active(tx time slot + rx time slot).
- the EDGE connection speed with a EDGE class 12 multislot device is asymmetrical, 4 time slots in reception (236800 bps max in MCS9), 4 time slot in sending (236800 bps max in MCS9) and 5 time slot in active(tx time slot + rx time slot).
- the WCDMA connection speed is symmetrical, 384kbps in reception and sending.
- The HSDPA connection speed with a category 8 device is asymmetrical, 7.2Mbps in reception and 384kbps in sending.
- The controlling application of the module must have a TCP/IP - PPP software stack to interface with the PSD modems.
- The controlling application must relay on some ISP that may be the Network Operator of the SIM or USIM to gain access to the internet through the PSD connection.
- Because of the point before, the receiving application must have internet access either.
- Since the communication is based upon TCP/IP packets, then it is possible to talk contemporarily with more than one peer.

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- When required, the data security in internet must be guaranteed by security protocols over the TCP/IP that must be managed by the controlling application.

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7. GPS operations (UC864-G only)

7.1. Introduction

The UC864-G module is equipped with gpsOne that is controllable by the modem using a set of AT commands or dedicated NMEA sentences.

7.2. UC864-G Serial Ports

4 serial ports are available on the module:

- UART SERIAL PORT
- MODEM USB SERIAL PORT
- AUX USB SERIAL PORT
- NMEA USB SERIAL PORT

7.3. WGS 84

GPS receivers perform initial position and velocity calculations using an earth-centered earth-fixed (ECEF) coordinate system. Results may be converted to an earth model (geoid) defined by the selected datum. For UC864-G the default datum is WGS 84 (World Geodetic System 1984) which provides a worldwide common grid system that may be translated into local coordinate systems or map dates. (Local map dates are a best fit to the local shape of the earth and not valid worldwide).2

7.4. NMEA 0183

The NMEA 0183 is a specification created by the National Marine Electronics Association (NMEA) that defines the interface between other marine electronic equipment. The standard permits marine electronics to send information to computers and to other marine equipment. GPS receiver communication is defined within this specification. The actually supported version is 2.2

The provided NMEA sentences are:

GGA Time, position and fix type data.

GLL Latitude, longitude, UTC time of position fix and status.

GSA GPS receiver operating mode, satellites used in the position solution, and DOP values.

GSV The number of GPS satellites in view satellite ID numbers, elevation, azimuth, and SNR values.

VTG Course and speed information relative to the ground.

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RMC Time, date, position, course and speed data.

NOTE:

By Default the NMEA USB port provides the following sentences:

GGA, GSA, GSV, RMC.

7.4.1. GCA - Position System Fixed Data

This sentence provides time, position, and fixes related data for a GPS Receiver. Table A contains the values for the following example:

$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18

Table A

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table B
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

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Table B

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

7.4.2. GLL - Geographic Position - Latitude/Longitude

This sentence provides latitude and longitude of vessel position, time of position fix and status. Table C contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41

Table C

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	*A*		*A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00)*
Checksum	*41		
<CR> <LF>			End of message termination

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7.4.3. GSA - GNSS DOP and Active Satellites

This sentence reports the GPS receiver's operating mode, satellites used in the navigation solution reported by the GGA sentence and DOP values. Table D contains the values for the following example:

$GPGSA,A,3,07,02,26,27,09,04,15, , , , , , ,1.8,1.0,1.5*33

Table D: GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table E
Mode 2	3		See Table F
Satellite Used1. Satellite used in solution.1	07		Sv on Channel 1
Satellite Used1	02		Sv on Channel 2
....			
Satellite Used1			
PDOP	1.8		
HDOP	1.0		
VDOP	1.5		
Checksum	*33		
<CR> <LF>			End of message termination

Table E: Mode 1

Value	Description
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

Table F: Mode 2

Value	Description
1	Fix not available
2	2D (<4 SVs used)
3	3D (>3 SVs used)

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7.4.4. GSV - GNSS Satellites in View

This sentence reports the number of satellites (SV) in view, satellite ID numbers, elevation, azimuth and SNR value. There could be four satellites information per transmission so, if the number of satellites in view is bigger, separated GSV sentences will be generated. The number of sentence in transmission and the total to be transmitted is shown in the first 2 fields of the sentence. Table G contains the values for the following example:

$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71

$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Table G: GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number1	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	
Azimuth	048	degrees	
SNR (C/No)	42	dBHz	
....	....	....	
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

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7.4.5. RMC - Recommended Minimum Specific GNSS Data

This sentence reports Time , date, position, course and speed data. Table H contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table H: RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*10		
<CR> <LF>			End of message termination

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7.4.6. VTG - Course Over Ground and Ground Speed

This sentence reports the actual course and speed relative to the ground.

Table I contains the values for the following example:

$GPVTG,309.62,T, ,M,0.13,N,0.2,K,A*23

Table I: VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62		Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	knots	Measured horizontal speed
Units	N	Knots	
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	*A*		*A=Autonomous, D=DGPS, E=DR*
Checksum	*23		
<CR> <LF>			End of message termination

7.5. Checking GPS Device Functionality

After a proper power on, the device is ready to receive AT commands on the MODEM serial port.

The GPS receiver also will be automatically powered on and it will start the scan of the available GPS signals.

On the NMEA USB port (default 115200 bps, 8, n, 1) there must be presence of the NMEA sentences.

7.6. Controlling GPS Receiver

The UC864-G module is provided by a set of AT commands that permits to configure and use it through the MODEM serial port. For the Full list of available commands please refer to the UC864-G AT commands Specification

7.6.1. Power Control of GPS Receiver

The GPS receiver is by default switched off at the first power on. If is necessary to switch it on or off is possible to use the AT$GPSP command. The GPS receiver is

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usable if the GSM module is switched on (or at least in power saving). This command also switches off the GPS antenna supply.

Syntax of the command AT$GPSP=<status>

Where:

<status> - 0 GPS controller is powered down(default), 1 GPS controller is powered up, ? Returns the range of values accepted

AT$GPSP? will return the current status.

Example 1: (to switch on the GPS)

AT$GPSP=1<CR>

OK

Example 2 : (to know the status)

AT$GPSP?<CR>

The answer will be:

$GPSP: 0

OK

7.6.2. GPS Reset

With the command AT$GPSR=<reset type> is possible to reset the GPS module.

Parameter:

<reset type>

0 - Hardware reset: the GPS receiver is reset and restarts by using the values stored in the internal memory of the GPS receiver.

1 - Coldstart (No Almanac, No Ephemeris): this option clears all data that is currently stored in the internal memory of the GPS receiver including position, almanac, ephemeris, and time. The stored clock drift however, is retained. It is available in controlled mode only.

2 - Warmstart (No ephemeris): this option clears all initialization data in the GPS receiver and subsequently reloads the data that is currently displayed in the Receiver Initialization Setup screen. The almanac is retained but the ephemeris is cleared. It is available in controlled mode only.

3 - Hotstart (with stored Almanac and Ephemeris): the GPS receiver restarts by using the values stored in the internal memory of the GPS receiver; validated ephemeris and almanac. It is available in controlled mode only.

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Example :

Let's suppose to perform a cold start of the GPS receiver.

AT$GPSR=1<cr>

OK

The Receiver will clear all the parameters in its memory and it will start a new scanning of the available satellites.

7.6.3. GPS Antenna Management

The GPS receiver needs an active antenna. This antenna could be supplied by the module. By default the antenna supply is set to ON (the provided voltage is related to VREG_GPS so the GPS antenna have to accept a range of supply voltage from 3.0 to 3.1V DC)

With the AT$GPSAT command is possible to define this setting. The syntax is
AT$GPSAT=<type>

Parameter:

<type>

0 - GPS Antenna not supplied by the module

1 - GPS Antenna supplied by the module (default)

7.6.4. GPS Parameters Save

This command allows saving the set parameters in the module's memory

Syntax of the command

AT$GPSSAV

After this command restart the module to update the modifications.

7.6.5. Restore GPS Parameters

This command allows restoring the factory default parameters for the GPS module

Syntax of the command :

AT$GPSRST

After this command restart the module to update the modifications.

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7.6.6. Read Acquired GPS positon

This command allows reading the acquired position of the GPS receiver

Syntax of the command

AT$GPSACP

The response syntax is:

$GPSACP:<UTC>,<latitude>,<longitude>,<hdop>,<altitude>,<fix>,<cog>,<spkm>,<spkn>,<date>,<nsat>

The fields contain the following information:

<UTC>: (referred to GGA sentence)

hhmmss UTC of Position

Values:

hh (hour) 00 to 23

mm (minutes) 00 to 59

ss (seconds) 00 to 59

<latitude>: (referred to GGA sentence)

ddmm.mmmm N/S

Values:

dd (degrees) 00 to 90

mm.mmmm (minutes) 00,0000 to 59.9999

N/S: North / South

<longitude>: (referred to GGA sentence)

dddmm.mmmm E/W

Values:

ddd (degrees) 00 to 180

mm.mmmm (minutes) 00,0000 to 59.9999

E/W: East / West

<hdop>: (referred to GGA sentence)

x.x Horizontal Diluition of Precision

<altitude>: (referred to GGA sentence)

xxxx.x Altitude - mean-sea-level (geoid) (meters)

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<fix>:

0 - Invalid Fix

2 - 2D fix

3 - 3D fix

<cog>: (referred to VTG sentence)

ddd.mm Course over Ground (degrees, True)

Values:

ddd: 000 to 360 degrees

mm 00 to 59 minutes

<spkm>: (referred to VTG sentence)

xxxx.x Speed over ground (Km/hr)

<spkn>: (referred to VTG sentence)

xxxx.x Speed over ground (knots)

<date>: (referred to RMC sentence)

ddmmyy Date of Fix

Values:

dd (day) 01 to 31

mm (month) 01 to 12

yy (year) 00 to 99 (2000 to 2099)

<nsat>: (referred to GSV sentence)

nn Total number of satellites in use

Example:

$GPSACP:080220,4542.82691N,01344.26820E,259.07,3,2.1,0.1,0.0,0.0,270705,09

OK

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8. Service and Firmware Update

The Telit Modules firmware is updated through the Serial Interface normally used for the AT Commands.

It is suggested to provide an RS232 interface on the User Printed Circuit Board (where the Telit Module is soldered) to perform the physical connection between the Telit module and a Windows-based PC. That simple circuitry makes the firmware updating easy when a new firmware version is released.

During the User Application development or evaluation phase of the Telit module, the RS232 interface or the USB port implemented on the Telit Evaluation Kit (EVK2) [6] can be used to connect the Telit module to a Windows-based PC on which a dedicated tool for firmware updating is running.

Telit provides the User with two tools to update the firmware of the module. The following paragraphs describe them.

NOTE:

GT terminals are complete encased modems. They do not need the Telit Evaluation Kit (EVK2) to perform testing, evaluation and Firmware Update.

8.1. Step-by-Step Upgrade Procedure (TFI)

The firmware update can be done with a specific software tool provided by Telit that runs on Windows based PCs.

First the program will erase the content of flash memory, then the program will write on the flash memory. To update the firmware of the module, we suggest the following procedure:

- Run the file *TFI_xxxx.exe*. The following window must be displayed, Select the language preferred by pressing the correspondent button.

- The End User License Agreement will appear. Please, read it and accept the terms if you are going to proceed.

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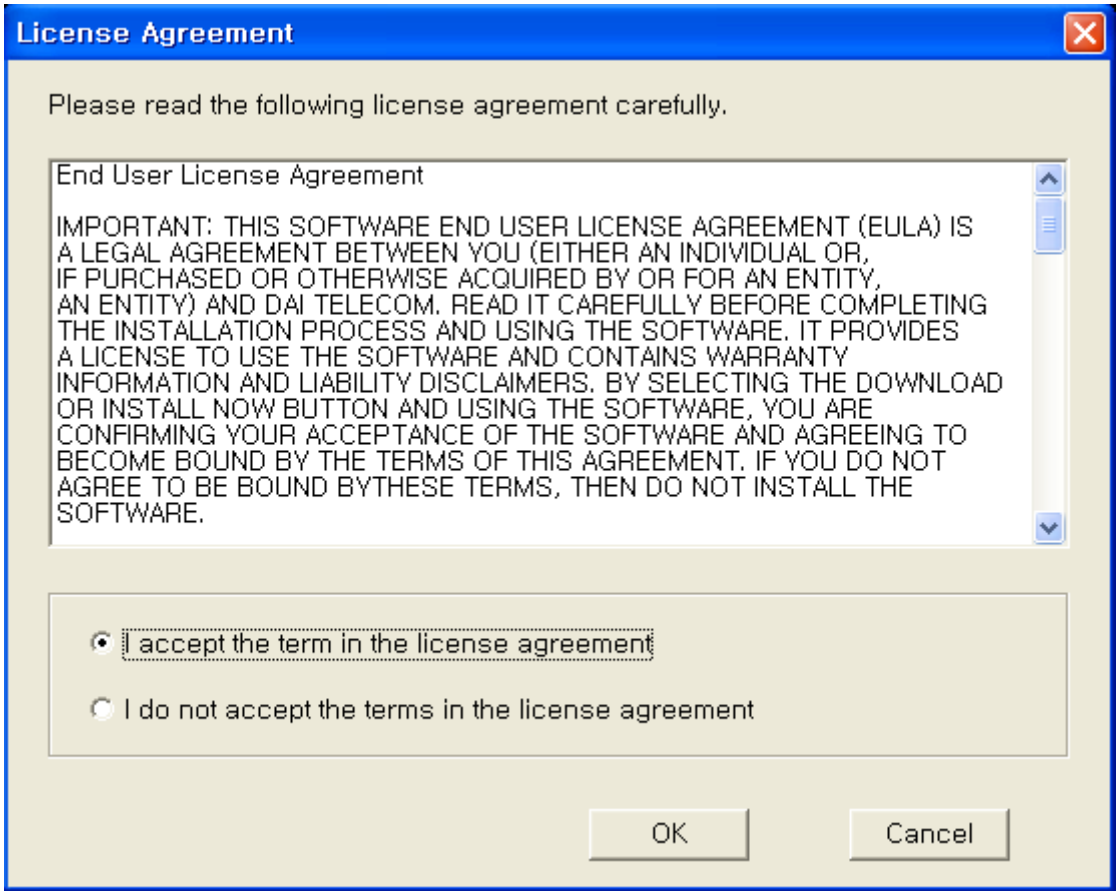
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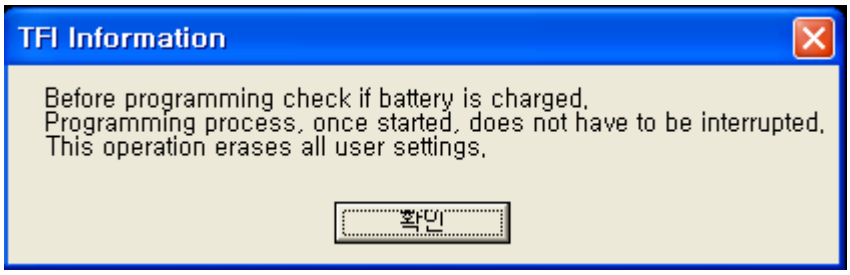
End User License Agreement
IMPORTANT: THIS SOFTWARE END USER LICENSE AGREEMENT (EULA) IS A LEGAL AGREEMENT BETWEEN YOU (EITHER AN INDIVIDUAL OR, IF PURCHASED OR OTHERWISE ACQUIRED BY OR FOR AN ENTITY, AN ENTITY) AND DAI TELECOM. READ IT CAREFULLY BEFORE COMPLETING THE INSTALLATION PROCESS AND USING THE SOFTWARE. IT PROVIDES A LICENSE TO USE THE SOFTWARE AND CONTAINS WARRANTY INFORMATION AND LIABILITY DISCLAIMERS. BY SELECTING THE DOWNLOAD OR INSTALL NOW BUTTON AND USING THE SOFTWARE, YOU ARE CONFIRMING YOUR ACCEPTANCE OF THE SOFTWARE AND AGREEING TO BECOME BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO BE BOUND BYTHESE TERMS, THEN DO NOT INSTALL THE SOFTWARE.
I accept the term in the license agreement
I do not accept the terms in the license agreement
OK
Cancel

- Press OK to the initial message.


TFI Information
Before programming check if battery is charged,
Programming process, once started, does not have to be interrupted,
This operation erases all user settings.
확인

Note: In connection with the UC864 modules, charged battery has to be understood that the power supply must not be disconnected during the firmware update.

- Download ready screen – If “Diagnostic” COM Port is automatically detected then the baudrate is fixed to 230400. But automatically port detection is depending on Window OS and it is targeting on Window XP. If

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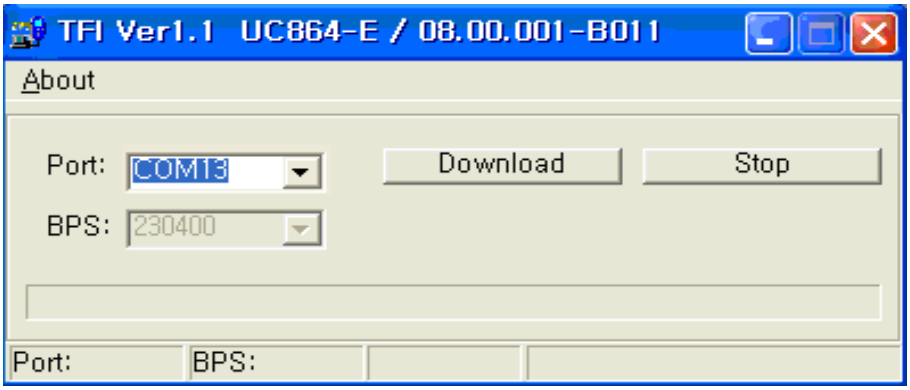
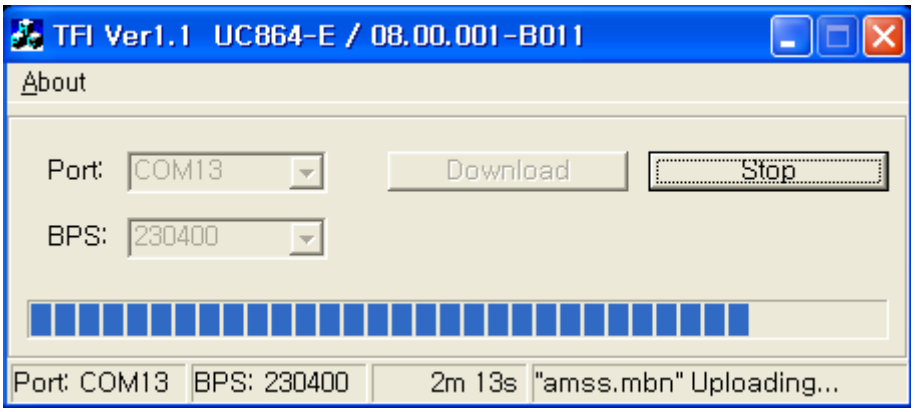
COM Port is not detecting then must recheck that connecting status of modem USB cable and USB driver installation. Firmware Version displayed on Title bar is new firmware version and this version will be updated to the module.



- Select the right COM port and speed. Note that to go faster than 115200 you need a special hardware on the PC. Then Press the Download button and within 5 seconds power-on the UC864.
- Firmware Version displayed on Title bar is current firmware version.



Wait for the end of programming green message OK.

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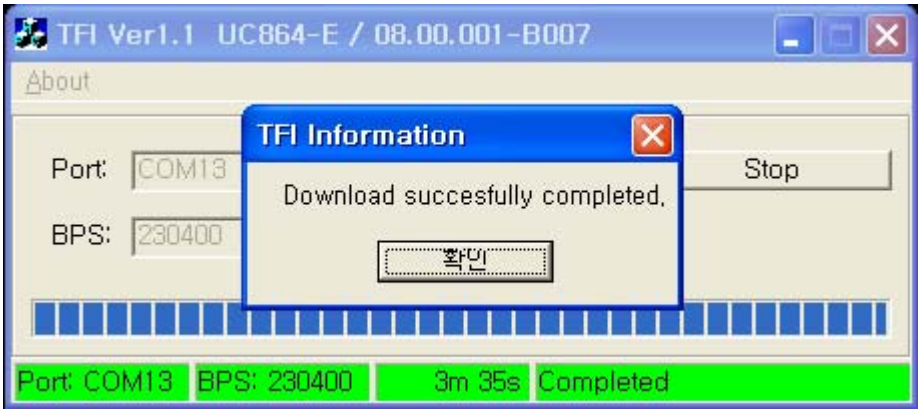

The Telit UC864 module is now programmed with the new firmware.

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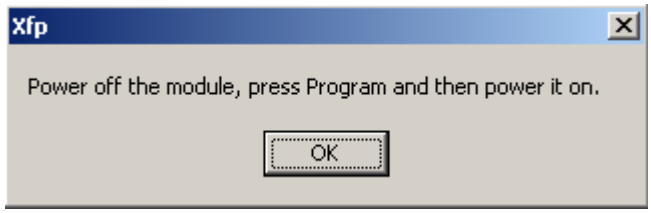
8.2. Xfp Tool

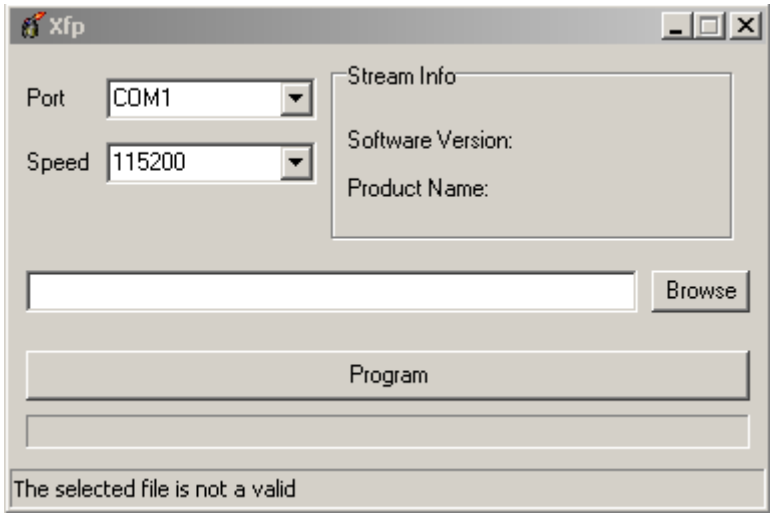
The firmware update of the module can be performed with the Xfp Tool provided by Telit. It runs on Windows based PCs. It erases the flash memory content, then it downloads the new firmware on the flash memory.

8.2.1. Step-by-Step Upgrade Procedure

To update the Telit Module firmware, follow the procedure:

1. collect information about the Telit Module and Software version using the following AT commands:
   - AT+CGMR<cr>, returns the Software version information;
   - AT+CGMM<cr>, returns the Telit Module identification.
2. Switch OFF the Telit Module.
3. Run the *Xfp.exe* tool, the following windows are displayed. Power OFF the module if needed then press OK button.





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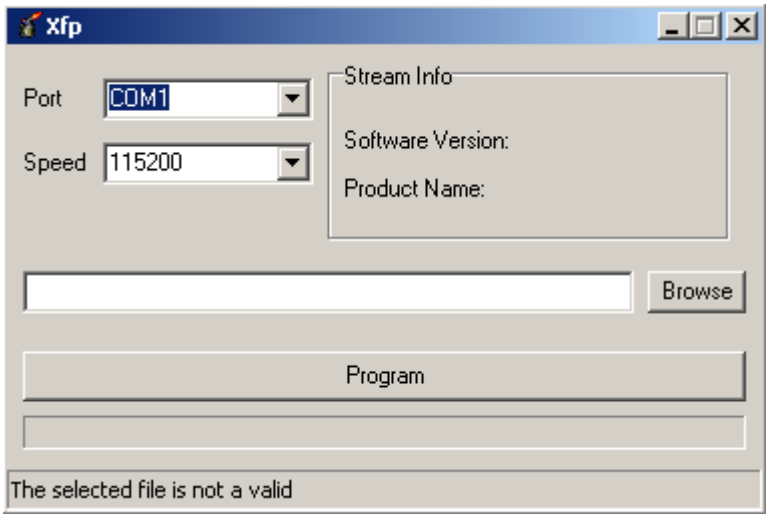
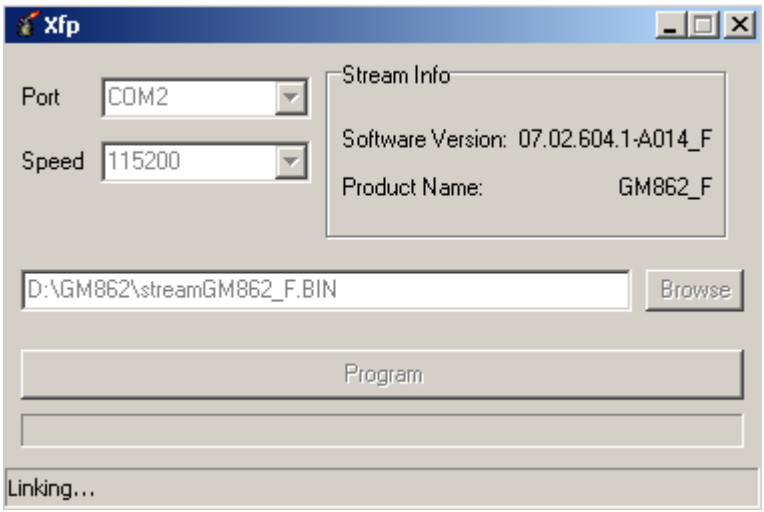
4. After pressing OK button on the screen is displayed only the following windows.



5. After selecting COM port, speed[1] and stream file (stream files holds new firmware) press Program button, a flashing blue bar appears on the displayed window. The following window is displayed on the screen.



[1] To use speed grater than 115200 Bps a dedicated hardware on PC is needed.

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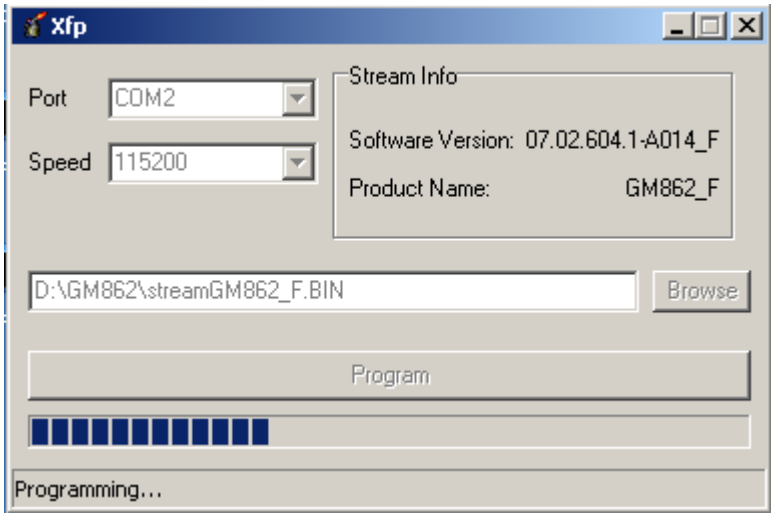
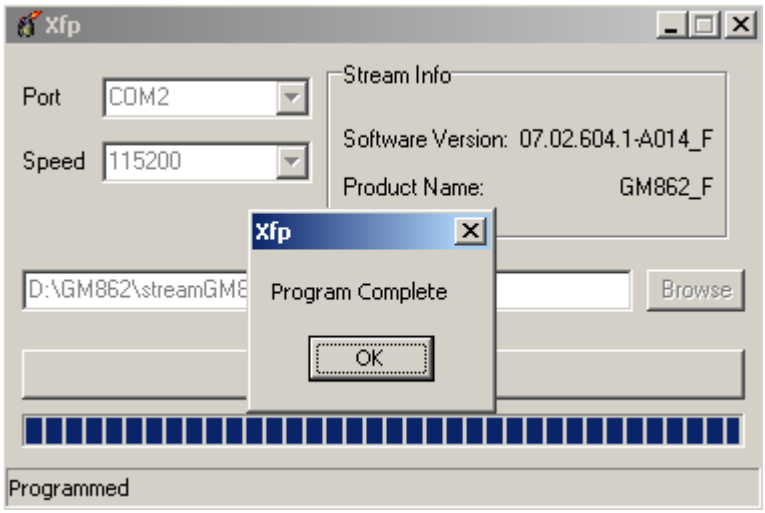
6. After powering ON the module the following window is displayed on the screen. The programming is in progress



7. The following window is displayed on the screen when the module is successfully programmed.



8. Now the Telit module is programmed with the new firmware. Press OK button and exit the tool.

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